TROPICAL AGRICULTURE

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CONTENTS.

	PAGE.
Cacao Problems	129
Tropical Dairy Cattle	131
Sugar-cane Experiments	134
West Indian Agriculture	136
Colonial Agricultural Service	137
Co-operation	138
Egyptian Cotton Plant	138
Deficiency Disease Enquiry	139
Sugar in Fiji	140
Tropical World Notes	142
Cane Syrup Experiments	144
British Guiana Journal	144
Adco Manure	144
Sugar in 1927	146
Cotton Note	147
Mycological Note	148
Rhodesian Settlers	148
Rubber Restriction	149
Rubber in 1927	150
Reviews	150
Books Received	151
Chemical Notes	152
Sugar Notes	153
College News	154
British Guiana Expedition	155
Trinidad Cacao	155
Acknowledgment	155
Trend of the Markets	156
Cotton Statistics	156

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CACAO PROBLEMS.

GENERAL principles are often best illustrated by specific cases, and perhaps no better commentary could be made on the need for Research Stations of the type recommended by the Imperial Agricultural Research Conference than is afforded by consideration of the scope which exists for fundamental scientific investigation within the cacao industry.

Cacao is a tree crop with a long life-history, and if there be any truth at all in the idea of evolution as applied to agricultural development, the time must surely come when the tree crops of the Tropics can only be grown with economic success under conditions of horticultural efficiency comparable with those at present applied to the fruit trees of the Temperate Zones.

In other words, cacao cultivation must ultimately become as highly developed a branch of plant industry as any that exists to-day, and the signs are not wanting that evolution of the industry is already beginning to move in that direction. Increased production per acre is already indicated as essential for the prosperity of the industry in some of the older cacao countries, and this can only come about by more intensive cultivation.

The parts to be played by research in the transition are more than can be considered in one short article, but enumeration of a few of them will serve to illustrate the scope and functions of a Research Station such as the Imperial College of Tropical Agriculture, which from its position in a colony where cacao is the chief crop has naturally a particular interest in it, and is specially fitted to undertake research upon it.

In the first place, horticultural efficiency will demand that definite varieties of the crop be recognised and grown. No apple-grower could be financially successful with an orchard containing a mixture of trees of all varieties, including a considerable percentage of crab-apples, yet almost any cacao estate exhibits a state of affairs very similar to this, and although uniformity may be of less importance in cacao than in apples, the existing heterogeneity is a highly important cause of low yields and inferior quality. Isolation of the most desirable types from the existing mixture involves extensive genetic research into the constitution of the cacao crop if it is to be done thoroughly and with expedition, and this is work which can be done well, and can only be handled in all its aspects, by a Research Station.

Problems of propagation are generally accepted in England and the Dominions as among the most important affecting fruit crops of which definite varieties exist. All the best types seem to be complex hybrids, and will not "breed true" from seed, hence the almost universal practice of vegetative propagation by budding or grafting. The thorough examination of stocks, their physiological characteristics, and their inter-relationships with the scions put upon them, claims much of the attention of the staff of more than one horticultural Research Station, and involves investigations in plant physiology of a distinctly advanced kind. In the case of cacao, the method of propagation is of no less importance, and likewise demands scientific investigation. Cacao trees are apparently in the same hybrid condition as apple trees, and when the most desirable types have been selected the only way to multiply them will probably prove to be by budding. Research is also needed to be directed toward the production of good types which can be propagated by seed, but this line of work is so long and tedious that it must necessarily take a subordinate position for its practical value.

The plant physiologist should also find a very profitable field of work in the study of seasonal variations in the cacao tree itself, the fluctuations in its reserves of nutrient materials, and the precise conditions, both internal and environmental, which determine and control the fruiting process. Such work can only be done by officers who are in a position to give practically all their time and thought to the problems in hand, unhampered by general administrative duties, and this consideration alone is sufficient to emphazise the special functions and advantages of the Research Station.

Increased efficiency of cultivation can be obtained in three ways, of which two have been indicated—by isolation of better types of trees, and by application in cultural methods of knowledge of the physiology of the trees. The third way is by reduction of the present losses of potential crop by diseases and pests, and the discovery of means by which this can be done is the research field of the plant pathologist. The border line between health and disease is quite indefinite, and as a natural consequence the plant pathologist must work in close co-operation with the physiologist where their interests overlap. The Research Station, with its team of specialist officers, provides the opportunity for this necessary co-operation.

All these problems are botanical and horticultural, and concern the central requirement of maximum yield per acre. But as the cacao leaves the tree a new set of problems arises for consideration. There is need for research into fermentation processes, in order that when they are better understood they may be better controlled, and this is the joint domain of the microbiologist and the chemist. Nor is their work entirely distinct from that of the botanists, for the knowledge obtained on both sides must be pooled before certain vexed questions can be settled, as for example that of the precise parts played in determining the quality of the final product by the genetic constitution of the trees, by climatic and soil conditions, and by technical treatment after picking.

In the absence of Research Stations no Department exists which could efficiently prosecute and co-ordinate all these lines of enquiry in addition to other duties. Work has of course been done, at different times and in different places, along most of the lines mentioned, but its full effect has not been achieved on account of its scattered nature. The time seems ripe now for a broad and comprehensive policy of research.

One of the essential characteristics of a Research Station should be that it looks far ahead, and anticipates probable future developments in agricultural requirements. For this reason its main function has been concisely and aptly termed "long range research." With long term crops, of which cacao is an excellent example, the need for this long view is especially apparent. Genetic research on such a crop cannot possibly produce its complete results within a century, and the continuity of policy ensured by an established institution will be a pivotal factor in success.

On the other hand, the benefits to be derived from "long range research" are by no means all to be deferred for a long period. Scientific knowledge is acquired little by little and can be applied in the same way. The Research Station is only one unit in a scientific agricultural service, and its duty is to release information continually as it is acquired. It is for local Agricultural Departments to take that information and apply it to local conditions and to hand it on in understandable form to the private agriculturist. And it may be added that it is for the agriculturist himself to apply that information to his own crops as far as ever it will go. If all the information that has already been acquired by research were fully applied, there would still be need for much more, but there would also be a very great improvement in the general standard of crops throughout the world, and perhaps especially in the tropics.

GROUNDNUT CROP.

THE final All-India General Memorandum on the groundnut crop of 1927-28 shows that the total area is 5,244,000 acres, as compared with 4,321,000 acres in 1926-27, or an increase of 21 per cent. The total yield is estimated at 2,571,000 tons of nuts in shell as against 2,046,000 tons last year.

The condition of the crop is reported to be good except in Burma, where it is much below the average.—(*The Planters Journal and Agriculturist*, Vol, VII, No. 5.)

TROPICAL DAIRY CATTLE.

BY

CAPTAIN H. V. METIVIER, O.B.E., B.SC., M.R.C.V.S.

THE question of the milk supply in the tropics is becoming a very important one, because owing to the excellent educational work of medical men the demand for more fresh milk is increasing daily, and the use of condensed milk in large Hospitals, Asylums, Almshouses and Settlements is being reduced and a supply of fresh milk substituted.

However, together with the recommendation for a bigger output, Sanitary Authorities are giving considerable attention to the conditions under which milk is produced, so that the question that has to be tackled is an increased output of clean milk.

This work must necessarily fall on the shoulders of the Agricultural and Veterinary Departments in the tropics, because they are responsible for the proper management as well as the improvement of livestock in these areas and the matter is, without doubt, receiving considerable attention.

In temperate climates the production of clean milk is really an easy matter as compared to the output of the same article of food in the tropics, because, in the first place, the farmer is dealing with typical dairy cattle and not with the highly nervous breeds which one encounters in the tropics: these milch cows cannot supply milk without calves at foot, that must suckle them before they are milked, and this makes dry milking an impossibility, then again they will not allow themselves to be washed and groomed in the same manner as ordinary milch cows do, and further owing to their nervous temperaments it is impossible for them to be milked without their legs being strapped which means that milkers cannot keep their hands clean during milking hours unless they wash them after milking each cow.

Wet milking, dirty cows and filthy hands help considerably to increase the bacteriological count of milk in all countries, but in the tropics it must be pointed out that this is a most serious handicap because the farmer has not the same means of readily cooling his milk as he has in colder climates, and so checking the rapid multiplication of bacteria.

It is quite an easy matter with an ordinary water cooler to get milk to within 4°F. of the temperature of water and this means that in the tropics it is impossible to get milk anything like 50°F. by water cooling. Bacteria multiply readily at temperatures above 60°F., so that the dairymen in the tropics using the type of cows which he does, starts off with a higher bacterial count in the milk, and the organisms multiply rapidly from the time they leave the pail until they reach the consumer owing to the excellent medium in which they are placed.

It is for this reason that milk in the tropics is so to speak distributed as soon as it leaves the cow's udder, whereas in colder places it is customary to deliver afternoon milk for morning consumption, and the morning milk for afternoon use with the bacterial count still quite low. It is true that, with modern refrigerating plants, milk can readily be cooled in the tropics to the same temperature as it is cooled in temperate regions, but these appliances are not within the reach of the small man, who is, as a rule, the dairyman in the tropics. It can now be appreciated that the chief obstacle in the output of clean milk in the tropics is due to the cattle themselves, because using such dairy cows the farmer has necessarily to start with a dirty article so that in spite of whatever cooling the milk might receive where a refrigerating plant is used the bacterial count is necessarily high.

No definite steps have been taken as yet to grade milk in the tropics, and the question, although a big one, will soon however have to be carefully considered.

The work, then, for all those interested and responsible for milk production in the tropics to bear in mind, is that the dairy cattle have to be improved, and this must be carried out before other factors are considered. Milking overalls and caps, milking machines, partly covered milking pails, sterilizing plants, the withdrawal of the first few drops of milk from each teat into a separate vessel before milking into the pail, are all important points which help to make milk clean, but they are of really secondary importance in the tropics; the first problem to be tackled is the improvement of the dairy cattle themselves, animals that cannot respond to proper dairy conditions and which were never intended for the production of this article of food. This work is also of importance from another point of view, because together with the fact that it is impossible for such animals to produce clean milk all these cows are as a rule very poor milkers yielding at their best 10 lb. of milk per day when fresh and about 100 gallons per lactation period. The native dairy cow is therefore a failure both from the commercial as well as from the sanitary point of view.

In many of the colonies Zebu cattle have been introduced from India with the purpose of improving the working qualities of the native ox, and owing to the hardiness of this breed, they have become well established wherever they have been used for grading up. Zebu cattle are poor milkers and their dairy temperament is very poor, so that the introduction of this breed has in no way helped to improve cattle for dairying purposes. These cattle and their offsprings suffer very little from the effects of tropical diseases as compared with European cattle, and their excellent working characters are fully recognised. It is quite true that at times one comes across cows of this breed that are the exception to the rule; some may yield as much as 30 lb. of milk a day as well as suckle a calf, but even in these so-called high producers they must always have a calf at foot and go dry at once should the calf die: further it must be

pointed out in all such cows which suckle their calves in a dairy, that the calf receives the first milk which is the poorest and the strippings which are the richest, so that the milk from cows in such a dairy is not the best article which the animal can produce. Calves reared in this way always suffer from digestive troubles, usually have a staring coat and are pot-bellied; the heifers, when they reach to maturity, which is as a rule very late, are usually poor milkers. Figure III shows a herd of pure bred Zebu cattle, the progeny of cattle imported into the Colony of Trinidad from the Hissar Farm in India. These cattle have been well distributed throughout the Colony and all the native cows used for dairying purposes have a very large proportion of Zebu blood and consequently are poor producers and of a non milking strain.

One might at first sight suggest that the easiest way to improve native milch cows in the tropics would be to import ordinary cattle from Europe, Canada or the United States of America and turn the ordinary cow into meat, but this is a very expensive method and could only be carried out by large dairy companies. Then there is the further disadvantage that when dairy cows in milk are introduced into the tropics the death rate from diseases is as a rule high, chiefly from bovine piroplasmoses and even where such diseases do not exist the animals suffer considerably from the heat consequently their milk yield is not up to standard for these cows dry up after milking for a short time. They do improve at their next milking and their progeny do even better, but they require a considerable amount of attention and expense which might not be compensated by their returns at the pails.

Another method which might occur to many would be to introduce young dairy stock—calves between 6-9 months of age—these are as a rule more resistant to tropical piroplasmoses such as red water and anaplasmosis. These animals either become naturally immunized with a low death rate, or they may be vaccinated with blood from native stock with similar results. Here again this means of improvement cannot apply to the small man, as it needs a considerable outlay of capital with a long delay for returns. It is, however, an excellent way to improve dairy stock when the expenditure can be undertaken. This class of stock mature much earlier in life than native cattle especially in cases where there is a large percentage of Zebu blood. Young stock imported at 9 months of age can be used for breeding purposes 6-9 months later, although in some cases owing to severe attacks of piroplasmoses they fall away considerably in condition and are much older when they are fit for breeding. A slow but excellent method to improve the dairy qualities of milch cows is, however, the system of grading up, and it is the only means available for the peasant with the help of Agricultural Departments. This work can be carried out by introducing young dairy bull calves and using them for service as soon as they are ready. As pointed out above the death rate in such cattle is low and one has only to wait a short time for those animals to mature. The importance of a pure bred dairy bull at the head of a herd is fully recognised in all countries, but in the tropics where the animal has a dual purpose to perform, namely to increase the output of milk as well as to impart certain dairy characteristics his value is even much greater. In this article the merits of the different breeds of dairy cattle cannot be gone into in order for one to make a selection in grading up, but it can be taken for granted that any such breed would produce most encouraging results. The facts available are confined to the results obtained by grading up native cattle with a large percentage of Zebu blood with Friesian or Holstein cattle as they are referred to in Canada, the United States of America, South America and the West Indies.

Figure I shows a pure bred Friesian bull "King Butter Girl Walker" imported from the United States of America for this purpose, he was landed in the Colony as a calf with two pure bred Friesian cows heavy in calf and these two animals died after a month from the effects of Red Water. "King" developed Red Water Fever from which he recovered and he has now produced over 100 calves. A bull of this breeding when mated to native cows of Zebu strain produces an excellent grade Friesian—half bred—which are as a rule black in colour though at times some white patches appear on the body. They are well grown animals extremely hardy and are a great improvement on the ordinary native cow. It is contended by many that a great draw back to Friesian cattle for dairying purposes is that their butter fat content is low, but nowadays all Friesian bulls used for breeding in progressive countries are from high butter fat dams and by means of selection over a number of years the fat of Friesian milk has improved considerably. In the tropics when grading up with this breed of dairy cattle it will be found that the average butter fat is well over 3.5 per cent. and at times nearly 4 per cent. due no doubt to the Zebu, or native, blood in the progeny.

These half bred Friesian cows are excellent milkers for they give 45-50 lb. of milk when fresh and average easily 800 gallons of milk per annum. Figure V shows cows of such breeding and their dams were all poor producers that could only be milked with a calf at foot. All these cows can be milked without a calf though in some instances they had suckling calves in attendance during their earlier lactation periods. They are good feeders, their skin is black and the sun has no effect on them; they can be turned out to pasture and never become heavily infested with ticks. A great point in favour of this breed is that they are true to type, for when a bull and a cow of similar breeding are mated the same characteristics appear in the progeny. In Figure IV a bull of the same breeding as the cows is seen and it can be appreciated how well

TROPICAL CATTLE INDUSTRY

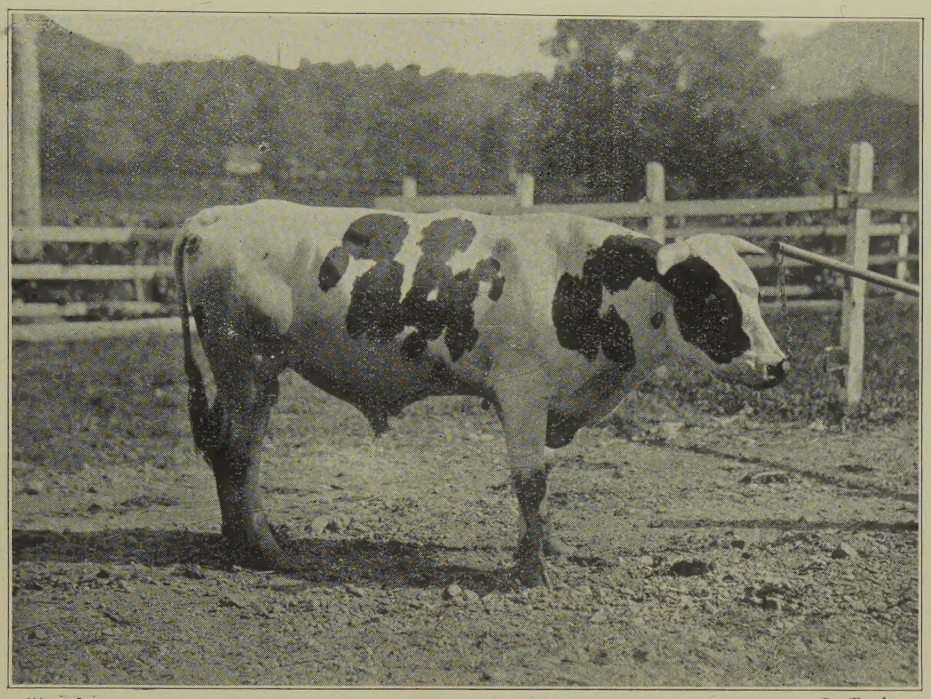

Photo by *L. Tucker.*

FIG. I—KING BUTTER GIRL WALKER.

Pure bred 7-year old Friesian Bull imported from United States of America.

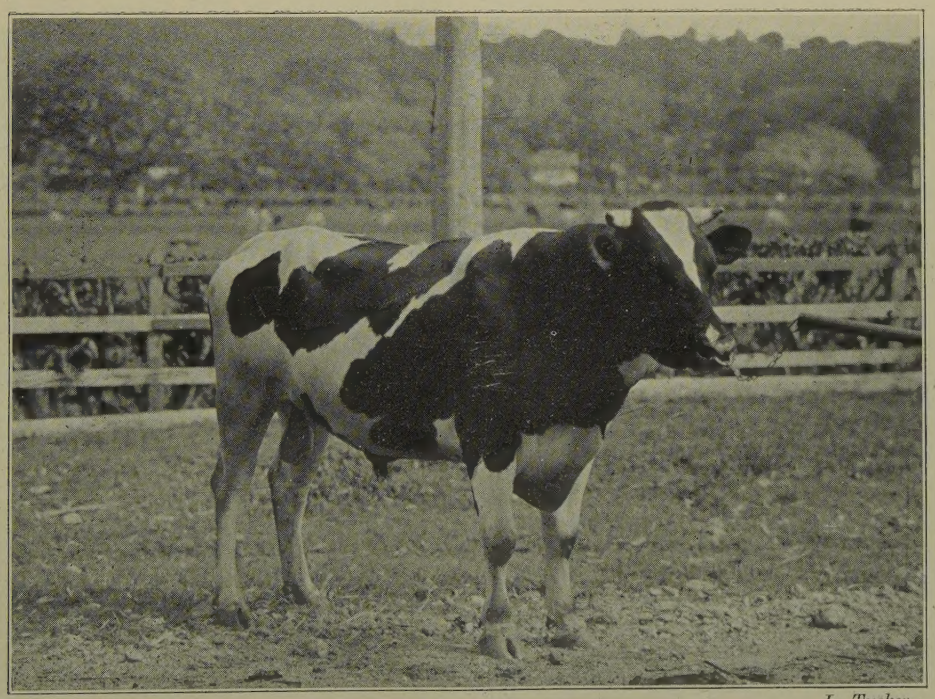

Photo by *L. Tucker.*

FIG. II—ROYAL DUKE.

Pure bred 3-year old Friesian Bull, son of "King Butter Girl Walker."

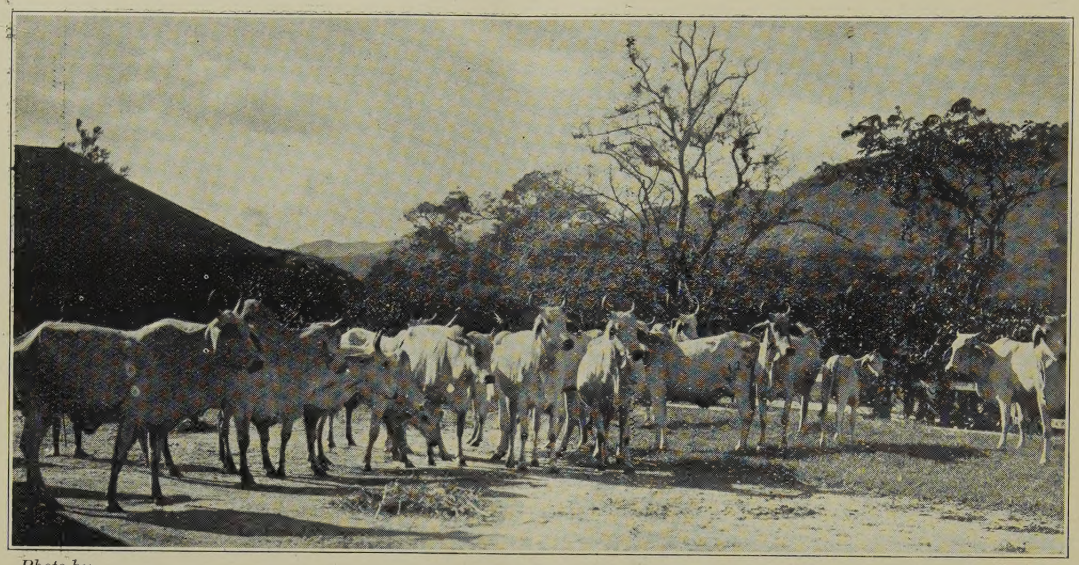

Photo by *L. Tucker.*

FIG. III—*Pure bred Zebu Herd.*

Photo by *L. Tucker.*

FIG. IV—GRADE FRIESIAN BULL.

Cross between a pure bred Friesian Bull and a Zebu dam.

grown and hardy these animals are. At this stage it should be mentioned that the oxen of this breeding are excellent workers and that on sugar plantations where working animals are of importance and where a dairy is maintained this type of cattle should be seriously considered as the means of achieving both purposes, for all the young heifers make good milkers and the young bulls splendid working oxen. The milk yield of the cows in Figure V average easily 8,000 lb. per annum, but the two best records will be given. One of these animals has given 13,360 lb. of milk in 424 days and is still milking, she is shown in Figure VII and it will be observed that she has a few white patches. Her best yield was 60 lb. of milk which was reached a month after freshening up in this lactation period, and it is safe to assume that this record is about the best given by any cow—imported pure bred included—in the West Indies.

The other half bred Friesian cow has yielded 14,337 lb. of milk in 596 days and her best yield was 50 lb. of milk per day. These cows have got good dairy temperaments in them, but they require a certain amount of care in handling, as for instance, whenever they are milked in order to get the best results they are fed part of their concentrates and this is most essential for a week or two after calving, otherwise they might fret for their calves. These cows are big roomy animals with well formed udders and nicely placed nipples showing good milk veins. During their lactation periods they are fed on an allowance of 3½ lb. of concentrates for every 10 lb. of milk, to which they respond, they are turned out to pasture for 5 hours every day for exercise and are given roughage in the form of succulent grasses in the wet season and cane tops and Uba cane, both of which are chopped up, in the dry season.

Their progeny as already mentioned are true to type and Figure VI shows eight cows of such breeding, chiefly the daughters of the cows in Figure V when mated to bulls as shown in Figure IV. These animals as heifers have averaged 500-600 gallons of milk per year and it will be interesting to see what their yields will be at future lactating periods. Their results, however, although quite good are not as brilllant as their dams but their dairy qualities show as much improvement for they milk without their calves and are easily handled. One of the best milkers of this lot is here shown in figure VIII and she has produced 5,000 lb. of milk in 275 days and is still milking. Another important characteristic of these two lots of half breed Friesian cattle, whether they are the progeny from pure bred bulls (Figure V) or from half bred bull and half bred dam (Figure VI) is that they mature much earlier than the ordinary highly graded Zebu cattle. Heifers as a rule are fit for breeding at two years of age and are in milk before they are 3 years old. The bulls of this breeding also mature earlier and in Trinidad for a good many years now they have been used as Government pasture bulls throughou the Colony with very good results. It is really remarkable that animals with as little as ¼ per cent. of Friesian blood are such an improvement on ordinary native milch cows, but of course their behaviour as dairy cattle is of a lower standard.

This work of grading is being continued and these half bred cows have all been bred to pure bred Friesian bulls—"King Butter Girl" and his son "Royal Duke" Figure II. The latter bull was bred by the Department of Agriculture in Trinidad on their farm. He is an excellent bull and has been greatly admired by livestock experts who have visited Trinidad. He is the son of two Friesians introduced into Trinidad as calves and both of whom suffered from Red Water Fever and recovered. The ¾ bred heifers by pure bred bulls out of the cows seen in Figures III and VI have all grown extremely well and they have been treated in the same way as the half bred calves, the hand rearing method being identical at all stages.

In order to get the best results in young stock that are reared on the pail it is most essential for one to give the animals considerable attention during their first six weeks of life. They should be fed at this period as much on whole milk as they can drink and this amount is usual 4-5 quarts per day. For the first week or ten days when the cows are milked three times instead of twice the young stock should have their milk allowance spread over three feeding periods, but after this they should get their milk in the morning and the afternoon. It is necessary that their milk should be at the body temperature when fed and the feeding bucket absolutely clean. As soon as the calves are a month old a good plan is to place a little dry feed made up of equal parts of crushed oats, maize meal bran and oilmeal, and at times the calves can be encouraged to take up this feed by giving them a small portion of crushed oats in their milk. After six weeks whole milk can be stopped and wherever possible separated milk substituted, or a boiled gruel. In both cases the young stock must have the grain feed already mentioned and the allowance should be 1-lb. per head daily. An excellent plan to correct digestive troubles is to add two or three pints of lime water to the calf's milk or gruel every week.

Lime water can easily be made by putting fifty pounds of freshly burnt or recently slaked lime in 40 gallons of rain water: this should be well stirred and then allowed to settle. The lime water made contains ten grains of lime to the ounce.

(To be concluded.)

The subscription to *Tropical Agriculture* is six shillings per annum, post free, Trinidad currency, to all countries within the British Empire or seven shillings, post free, Trinidad currency, to all other countries. Subscriptions can commence at any time during the year.

SUGAR-CANE EXPERIMENTS.

1. Cultivation Methods.

THE following is an account of an experiment in comparing various methods of planting and manuring cane which was carried out on the St. Augustine Experiment Station of the Trinidad Department of Agriculture. The scheme of the experiments was planned by my predecessor, Mr. J. S. Dash, and the work was carried out under the supervision of Mr. Brunton, the Assistant Superintendent of the Station.

Progress reports of the experiment have been written by Mr. Dash and will be found in *Tropical Agriculture*, Vol. II, pp. 93 and 122 and Vol. III, p. 154. The experiment was continued to the second ratoon crop when it was discontinued. The results of all three seasons are here brought together.

The soil of the field may be described as a light to medium silty loam, easily adapted to tillage by light animal-drawn implements. It was divided by drains into beds 22 feet wide and each plot occupied two beds, two varieties being used—B.H. 10 (12) and Ba 6032—one in each bed. The plots, five in number, therefore occupied ten beds altogether, so that we have a combined test of methods and a comparison of these two well-known varieties. The field which had been under cotton during the previous twelve months, was first ploughed and harrowed in the usual way, all rubbish and weeds being covered. Tables I and III give methods of treatment and results respectively.

Table I.—Treatment.

PLOT 1. .. ..Drilled, cuttings planted 7 feet between the rows and 2 feet in the rows. Pen manure at the rate of 15 tons per acre applied in the drills after canes had made sufficient growth, banks broken at the same time.

PLOT 2 .. ..Drilled, pen manure at the rate of 15 tons per acre applied in the drills at the time of planting, cuttings inserted through the manure and banks broken. Planting distance 5 feet by 5 feet.

PLOT 3 .. ..Drilled, sweet potatoes planted on the banks as a catch crop, cuttings planted 5 feet by 5 feet. Pen manure applied in the drills at the rate of 15 tons per acre as soon as sweet potatoes were dug, banks broken at the same time.

PLOT 4 .. ..Cane holes dug about 2 feet square and 6 inches deep. Planting distance 5 feet by 5 feet. Pen manure at the rate of 15 tons per acre buried in holes between stools.

PLOT 5 .. ..Flat planting—no drills or holes made. Well rotted pen manure at the rate of 10 tons per acre stirred in before planting; distance 5 feet by 5 feet, lines being marked out by small pony plough.

The plots were planted in November, 1923. All the furrows were made by a double mould-board plough, and the cultivation and after weeding were, as far as possible, the same for each plot. The only differences noted were that the cost of planting plot 4, was higher than the others, as most of the work had to be done by hand. In the case of plot 5, which was planted in the flat, the cost of stirring in the manure and liming was approximately equal to the cost of making furrows in the other plots. The number of cuttings used was about the same in all plots, the wide rows in plot 1 taking more cuttings to the row.

The rainfall for the duration of the experiment is given below:

Table II.—Rainfall, Government Farm, Valsayn.

Month.	1923.	1924.	1925.	1926.	1927.
January	2.78	2.03	2.07	.97	7.19
February	1.14	1.17	.94	.35	5.18
March	1.93	.16	1.88	.13	1.22
April	.50	.65	.39	.30	6.17
May	1.54	2.80	1.04	3.03	7.03
June	5.31	5.58	6.18	8.86	10.52
July	9.86	8.10	6.63	5.69	8.87
August	6.16	8.22	10.57	11.43	8.45
September	4.96	7.65	7.36	10.69	10.58
October	7.14	7.47	5.57	5.06	5.67
November	3.61	10.48	4.75	4.93	5.62
December	5.93	2.60	4.67	5.41	8.47
Total	50.86	56.91	52.05	56.85	84.97

In the first seventeen months, the rainfall was 71 inches, fairly well distributed: for the next twelve months, during the growth of the first ratoons, the rainfall was 48 inches; for the second ratoons, the season was unusually wet, rain having fallen in practically every month, and totalling up to the considerable figure of 70.8 inches.

The first harvest was made in February-March, 1925, after sixteen months of growth: the first ratoons were cut in March, 1926, and the second ratoons were cut in March, 1927.

The complete figures of the three harvests are given below.

Table III.—Yield per Acre in Tons.

	Variety.	1923-25.		1925-26.		1926-27.		Average.	
PLOT 1 ..	Ba. 6032	55.45	51.82	35.40	38.18	29.25	32.09	40.03	40.69
	BH. 10/12	48.19		40.95		34.93		41.36	
PLOT 2 ..	Ba. 6032	57.86	57.93	36.17	39.81	23.04	28.64	39.02	42.14
	BH. 10/12	58.00		43.45		34.35		45.27	
PLOT 3 ..	Ba. 6032	43.30	40.35	34.30	36.65	27.75	31.57	35.11	36.19
	BH. 10/12	37.40		39.00		35.40		37.27	
PLOT 4 ..	Ba. 6032	49.25	49.82	37.50	39.20	27.35	29.67	38.03	39.56
	BH. 10/12	50.40		40.90		32.00		41.10	
PLOT 5 ..	Ba. 6032	47.40	46.53	28.94	30.89	22.80	25.77	33.04	34.40
	BH. 10/12	45.70		32.83		28.74		35.76	
Average ..	Ba. 6032	50.65		34.46		26.04		37.05	38.59
Average ..	BH. 10/12	47.94		39.42		33.14		40.15	

The following observations drawn by Professor Dash (*loc. cit.*) are borne out by the final year's figures. In the first year, Plot 2 established a lead which has kept it at the top throughout the experiment, though in the 2nd ratoon crop it has actually dropped to fourth place. This was the plot that had the manure applied at the time of planting: the setts were, in fact, dropped directly on the manure in the furrow and covered at once. The worst plot, No. 5, was planted on the flat, and except as plant canes in the first year, has been very definitely the poorest, and it may be concluded from this that land should be ridged for cane in this part of the world. The next poorest plot is No. 3, where sweet potatoes were planted along with the cane, and where no manure was given till after the sweet potatoes were lifted. This Mr. Dash considers bad practice, especially with autumn planted cane, and though he admits the advantage of a catch crop in certain circumstances, he considers that in the conditions of this experiment, the growth of the cane is so prejudiced, that it results in a loss far greater than the value of the sweet potatoes. It is as well to emphasize this fact at the present time, when interest is being evinced in such crops as adjuncts to cane cultivation. If they are to be tried with cane, it would be better to try them with spring planted cane, and not under conditions which necessitate their being kept on until the dry season is beginning.

There is no indication that the wider spacing of the rows and the closer planting of the canes in the row, has had any appreciable effect on the yield.

There is no need to discuss the results at any greater length, as the figures in the Table should make them plain. The general conclusions may again be noted. Manure to canes should be applied early to get the canes away quickly, and catch crops may be rather dangerous things if they delay the application of manure to the cane; they may in addition compete with the cane itself for the available moisture.

R.C.W.

WE have to acknowledge with thanks the receipt of Messrs. Cooper, Pegler and Company's export catalogue No. 18 which can be obtained on application at 24-26 Christopher Street, Finsbury Square, London, E.C. 2. The catalogue which is well illustrated gives full details of the cost and uses of the "Vermorel Eclair" spraying, lime washing and disinfecting machines.

WEST INDIAN AGRICULTURE.

We publish below two reviews on (1) *A Report on Development of Agriculture in Trinidad. Empire Marketing Board, No.* 3 *and* (2) *Report on Development of Agriculture in the Leeward and Windward Islands and Barbados; Empire Marketing Board, No.* 5*; both Reports being by Mr. H. C. Sampson, C.I.E., Royal Botanic Gardens, Kew. The first review is by Mr. G. Evans, M.A., C.I.E., Principal of the Imperial College of Tropical Agriculture, Trinidad, and the second by Professor H. A. Ballou, M.Sc., Commissioner of Agriculture for the West Indies.*

1.—Agriculture in Trinidad.

MR. SAMPSON in this report makes a brief survey of the agricultural conditions of Trinidad and makes certain recommendations with a view to their improvement. He also suggests certain lines of development for the Local Agricultural Department.

As a tropical agronomist of very wide experience, his views of necessity command attention. He outlines the possibility of establishing an export trade in grape fruit and other tropical fruits such as the mango and the avocado pear. He stresses rightly the need for preliminary experiments in this direction and points out the opportunity of co-operation between the Trinidad Agricultural Department and the Low Temperature Research Station that is now being opened at the Imperial College of Tropical Agriculture.

His recommendations regarding coconuts naturally merit the closest attention and he is undoubtedly right in his remarks about the close distance at which many of the new plantations have been planted. Recent work by Dr. Briton-Jones of the Imperial College has indicated that the prevalent "wilt" disease is due to a condition of drought brought on each dry season owing to the fact that the coconuts have in large areas been planted on unsuitable soil, which do not give the plants a chance of developing a proper root system, and which also do not possess a suitable movement of soil water. The fact that this disease is due to physiological causes of this nature and not to a definite organism has also been definitely confirmed by him.

So far as rice is concerned his remarks about the possibility of this crop forming a useful crop with cane is interesting.

In the reviewer's opinion certain of the soils are far better fitted for rice than cane in any case. It is doubtful, however, whether there is any immediate prospect of an increase in the rice area, since labour is already barely sufficient in this Colony for the existing area under cultivation. Rice cultivation by means of mechanical implements is only possible in areas with a negligible rainfall and an abundant and reliable source of irrigation water and it is, for this reason, that it is widely practised as a plantation crop in Southern California and has been successfully introduced recently in the Murrumbidgee area of Australia. In Trinidad with its hot climate and prolonged rainy season, the methods of the east of transplanting and harvesting by hand will only be possible and lack of population at present prevents, any immediate prospect of extension.

G. E.

* * *

2.—Agriculture in the Leeward and Windward Islands and Barbados.

This report follows a visit by the author to the islands mentioned during the period from his arrival in Barbados 23rd June to departure from Trinidad for British Guiana 29th July.

The report was presented to the Under-Secretary of State for the Colonies under a covering letter by Dr. A. W. Hill, C.M.G., F.R.S.., Director, Royal Botanic Gardens, Kew.

Mr. Sampson acknowledges the help extended to him at the several islands and when it is realised that his experience of these islands ranged from a matter of a few hours to 5 days in only one instance, it is obvious that for him to get so comprehensive a glance at the local conditions his visit must have been facilitated in every way. Mr. Sampson recognises the differences between the islands and the excellent types of agricultural practice that have been developed to meet local conditions in several of the islands.

There are many things, however, that are not apparent on a first visit, and it is not strange that Mr. Sampson should have failed to realise what has been done in the past in the way of agricultural effort, nor that several of his suggestions which appear to be in the nature of putting forward new ideas refer to subjects that have been discussed and investigated in the past. The work of the Imperial Department in and through the Local Departments and their Botanic Stations appears not to have been appreciated.

The Report refers to the good work done at the Government Lime Experiment Station in Dominica. Reference might also have been made to the valuable experiments in the manuring and mulching of cacao at the Botanic Station, Dominica and the equally valuable experiments with Sugar-cane and Cotton in Barbados, Montserrat, Antigua, St. Kitts and Nevis carried out by the Local Departments and the extensive trials of great varieties of provision and minor crops in all the islands of these groups.

Mr. Sampson, while recognizing the differences between the islands in soil and rainfall conditions did not realize apparently that it has not been found possible in one island to develop a type of cotton suitable for the others. It is necessary for each island to maintain its own strain of pure seed.

It is true, as stated in the Report, that at the present time cotton as a crop is not of much importance in Barbados, but at one time it was of a very considerable value. The area planted under cotton in 1907-08 was over 7,000 acres, the annual average for the 5 years 1906-07 to 1910-11

was about 6,000 acres and the annual value of the crop in that period was over £60,000. This was at the time when the local Sugar Industry was in great difficulties, and the cultivation of a crop which added £60,000 to the value of the island's agricultural product was consequently of very material benefit.

The suggestion to substitute Upland cotton for Sea Island in the West Indies is not a new one. It has been suggested from time to time for the past 6 or 8 years but, so far, the suggestion has not found favour with the cotton growers. The several strains of Sea Island cotton have been specially developed to meet the needs of the environmental conditions in which they are grown. So far planters have preferred to take the chance of selling their Sea Island cotton on a congested market to entering the larger market with a lower priced cotton, with a prospect that yield per acre will not be greater and that the ravages of pests and diseases may be even more serious than is the case at present.

Mr. Sampson emphasizes the need of an Agricultural Service for these islands and the necessity for funds for its support being provided from outside sources, and in his covering letter to the Report, Dr. Hill strongly supports Mr. Sampson's views in this matter. The Imperial Department of Agriculture working under the direction of the Colonial Office and supported by funds from the Imperial Government supplied such a service in the past and the record of results obtained is a useful one.

The West Indian Islands are small in area, in population and in the extent of their agricultural interests. They are separated and varied in their resources and environmental characteristics and their communications for travel and post are comparatively infrequent. These conditions make any adequate agricultural service expensive and beyond the means of the islands concerned, but such service is essential for the continued welfare and prosperity of the island communities and it is necessary to look to an outside source for funds for its maintenance.

H. A. B.

CUBAN SUGAR RESTRICTION.

THE restrictions imposed on the Cuban sugar crop by a recent decree require that all mills shall have at least 10 per cent. of their crop standing in the field. Mills that have exactly the amount of sugar-cane estimated may cut only 90 per cent. and mills that have more cane than that estimated may harvest their quota, leaving the remainder unharvested. Mills that have less cane than that estimated may harvest only 90 per cent. and the difference between their allocations and the amount of sugar they manufacture will later be adjusted by a special decree at the discretion of the Sugar Committee.

COLONIAL AGRICULTURAL SERVICE.

Cmd. 3049, *His Majesty's Stationery Office, London.*

THIS is a report of a Committee under the Chairmanship of Lord Lovat which was appointed by the Secretary of State for the Colonies in June, 1927. Its terms of reference were "to formulate practical proposals for submission to the Colonial Government to give effect to the Resolutions of the Colonial Office Conference."

In the first place, Agricultural, or as they are alternatively named, Administrative Officers, are now to be included in the proposed unified Colonial Agricultural Service. In the original scheme Specialist Officers only were included. The new proposal is a wise one, and is to be commended from many points of view. If the original scheme had been persisted in, the recruitment of Agricultural Officers would have received a serious set-back. At present there is a marked dearth of agriculturally trained officers in Colonial Departments, which in the past have been staffed to a very large extent by specialists. The result has been that the extension work of these Departments has not always been so successful as it might have been.

The importance of this matter has obviously also influenced the Committee in their recommendations regarding the suggested Central Agricultural Council. It is now proposed to co-opt the services of an Agriculturist with tropical experience in addition, and this suggestion will be welcomed since perhaps the most serious criticism against the original proposal will now be removed.

The functions of a Central Research Station have been clearly defined and it is clearly the intention that such a station should not usurp the functions of an Agricultural Department in any way, but should act as a reinforcement. This Committee reverses the proposal of the Conference regarding the formation of a pool of scientific workers, and has come to the conclusion that no advantage would accrue from the formation of a permanent pool at present.

Definite suggestions are made regarding the constitution of the Central Council and the grades of the various agricultural posts in the various Colonies.

The financing of the whole scheme is to be met by a proposed cess of 1/400th of the total revenue of all Colonies coming within the aegis of the Colonial Office. It remains to be seen how far the various Colonial Governments will be prepared to accept these financial obligations. The idea of a unified Colonial service is one that nevertheless presents many attractive features.

G. E.

THE Cuban Department of Agriculture officially estimates the 1927 Cuban sugar crop as 4,509,000 tons, for which an average price of 2.779 cents was obtained, or a total value of $280,683,446 according to a report from the American Commercial Attache Todd, Havana.

CO-OPERATION.

Its Principles and Forms.

[*Lecture by Miss Anna Ornsholt,* D.T. (*Copenhagen*), *at the Clive's Hall, Accountant-General's Office, Fort St. George, Madras, under the auspices of the Madras District Educational Council.*]

MISS ANNA ORNSHOLT is clearly an idealist, but her ideals are not very clear. She eulogises the "olden days" when man "sang to his work, and the joy in him was transferred through his work to his surroundings." With the coming of the engine "the economic life of society degenerated into a demoralising routine of monotony . . . Work which in olden days was the joy of life is reduced to an act of working for wages and profit. That is the level to which humanity has actually fallen. . . . Men are so busy that they have few thoughts left for culture."

The lecturer is clearly ignorant of modern research into economic history. While the introduction of increased sub-division of labour and labour saving devices have admittedly increased the monotony of labour, this loss is nevertheless offset by increased production and additional leisure. The factory system did not originate the evils of excessive labour, but merely brought them into the limelight and has progressively furnished the means for their amelioration. Unfortunately man's education has not taught him to utilise his increased leisure in cultural pursuits.

Yet she views with favour the system which induces the native of Denmark, after having finished his day's work, to spend his time in his garden till 10 at night. She praises the people who go to their gardens at 3 or 4 in the morning. Her approbation lies in the fact that this system keeps father from the restaurant life with its drinking and smoking, provides cheaper and better food for the family, leads many people from meat-eating, and leads to better family health by providing out-door work. It would be interesting to ascertain whether this remarkable industry is dictated by the joy that it gives or by economic necessity. Her idea of "culture" appears to be peculiar. Surely her grievance with the existing economic system should lie, not in the additional leisure it has made available, but in its misuse.

One wonders how her claims of sex equality appealed to the Indian cultivator. While appreciating this desire one finds it difficult to realise how with this equality "the terrible poverty which pervades so many countries will disappear." Perhaps she will be good enough to explain.

C. Y. S.

The Editor requests that any subscriber who fails to receive *Tropical Agriculture* regularly should communicate with him immediately in order that the matter may be rectified.

EGYPTIAN COTTON PLANT.

Two papers by M. A. Bailey and T. Trought recently issued in the bulletins of the Ministry of Agriculture, Egypt, Technical and Scientific Service, embody the results of a great amount of painstaking research on the botany of the Egyptian cotton plant and state conclusions of considerable general interest.

The first paper ("The Development of the Egyptian Cotton Plant" *Bulletin* 60, 1926) records observations designed to obtain fuller information as to the actual way in which the individual plant grows and produces its flowers. The points dealt with are:—

The developmental period of the flower bud.—This from first differentiation to the opening of the flower was found to be not less than 42 days. Previous workers have given much shorter periods, on account of the difficulty of determining the stage of "first differentiation." In this work growing points were dissected out under the microscope, and it was found that a bud could be recognised, as a minute apparently formless lump of tissue, about nine days prior to the stage when the petiole of the subtending leaf first bends away from the main axis—from which stage to the open flower had previously been found to occupy 33 days.

The period of boll development.—This from the open flower to the opening boll was found to be 52 days, in close agreement with Balls' figure of 50 days (for a different strain) and Harland's of 51 days for Sea Island cotton in St. Vincent. Diseased bolls were found to open after a shorter period than healthy ones, and plants in boxes and plants under drought conditions showed a shorter period than plants in the open field. The factor operating in both the latter cases is thought to be soil temperature.

The development of the sympodia.—This was carefully followed, and it was shown that before the first internode has reached its final length, no less than four succeeding internodes have begun to develop. The average rate and also the average extent of elongation fall steadily with each successive internode, but the period during which elongation takes place remains practically constant, with a slight suggestion of an increase in period in the more distant internodes.

Flowering intervals.—The intervals between successive flowers were shown to be of similar order to those found by Harland in the case of Sea Island cotton. In the plants observed, the minimum temperatures which occurred at the time when the bud primordia were being differentiated had no effect on the interval between the flowers opening 42 days later, neither was there any connection between the length of the interval between successive flowers and the length of the internode between them. It is suggested that the constancy of flowering interval can be explained by assuming that all the internodes contain an equal number of

"original" cells, each cell being able to elongate for a definite limited period of time. The slight increase in period of development of the later internodes would result if, after a certain stage, the plant takes a little longer to lay down this number of cells.

Flowering curves.—The usual type of flowering curve is plotted from data collected on a number of plants and reduced to a basis of "flowers produced per plant per day." In the course of the present work curves were plotted of the flower production of single plants, flowers on monopodial or accessory branches being neglected. These "single plant" curves were found to be different in form from the "average" curve, and to be rhythmic in character, with their modal points about 6½ days apart.

This regular periodicity is believed to be connected with the average flowering intervals of the plants, with a certain carry-over of flowers from one day to the next. Certain curves, in which only a faint indication of regular periodicity was obtained, were found to show this periodicity clearly when the flowers which had shed in the bud stage were added at their correct theoretical intervals.

The second paper ("Growth, Bud-Shedding and Flower Production in Egyptian Cotton" *Bulletin* 65. 1927) deals with the relations between growth and flower-production and between bud-shedding and flower-production.

It is first pointed out that whereas rate of elongation of the main stem and branches increases to a maximum and then falls, a similar change in rate of differentiation of flower buds, as shown in the first paper, does not occur.

W. L. Balls was of opinion that "the principal cause of the daily fluctuations in the rate of flowering is to be traced to fluctuation in the rate of elongation of the main stem, about four weeks earlier" and obtained a fit with a shift of about 28 days between daily growth curves and daily flowering curves, which corresponded with his own estimate of the developmental period of the flower bud. The present authors, having shown that the developmental period of the flower bud is more nearly six weeks than four, consider the fit fortuitous, and were themselves unable to find a fixed relation between elongation and flowering at a 42-day interval or any other interval.

Evidence is then adduced that the factor having the most direct influence on fluctuations in flower production is bud-shedding. Data were obtained in three consecutive years by the use of catch-nets under the plants, the shed buds being collected daily and classified into ages according to size. In the fourth year every flower was dated as it opened, and it was noted at the same time where "gaps" occurred as a result of bud-shedding, the dates being calculated, from knowledge of the intervals which normally occur between successive flowers, on which the missing buds would have opened if they had not been shed.

In one particular case about 60 per cent. of the "possible crop" was lost through bud-shedding, whilst boll-shedding accounted for about 6 per cent, only. The authors think it probable that a 30-40 per cent. loss is quite normal at Giza from this cause. By far the greatest proportion of shedding takes place in buds which have attained a width across the epicalyx of about 2 millimetres only

These conclusions conflict with Balls' observation that shedding takes place almost entirely in the flower stage in Egypt, but they agree in important particulars with those of other workers, notably Harland (St. Vincent), Mason (St. Vincent), Lloyd (Alabama), and Prescott (Egypt), and the question of shedding in the Egyptian cotton crop is thus brought into line with observations on the same problem in other cotton-growing countries.

Both papers are supported by a large number of tables and curves, representing a heavy amount of work in the collection of data.

E. E. C.

DEFICIENCY DISEASES ENQUIRY.

AN account has been published in *Rural India* Vol. II, Nos. 4 and 5 about important research work under the direction of Lieut-Col. R. McCarrison, C.I.E., M.D., D.SC., LL.D., F.R.C.P., I.M.S., which is being carried out in the Laboratories of the Deficiency Diseases Enquiry at the Coonoor Pasteur Institute.

The object of the enquiry is to ascertain the nature of the diseases which are brought about directly or indirectly by unbalanced and poor quality foods in common use in India and to discover means for their prevention. Its scope is wide as it embraces the whole field of nutrition of man and animals, the determination by chemical and biological investigations of the value of the common food-stuffs of Indians, the devising of simple, cheap and nutritious diets for the races of India whose religion or circumstances in life require adherence to certain foods and food habits, and a study of the relations of nutrition to various problems of Agriculture and Animal Husbandry, such as the effect of soil, irrigation and manurial conditions on the nutritive value of food grains, vegetables, dairy, and fruit produce.

Special attention is being paid to the study of the part played by the vital factors in foods such as vitamins. For instance, whole-wheat (atta) and oatmeal are amongst the best cereal foods available for mankind but in the absence of certain vital factors, such as are contained in milk, these foods exercise a toxic action with the production of stone-in-the-bladder and the diseases on the urinary tract which follow it. By the simple expedient of adding a sufficiency of milk to the atta or oatmeal diets, these become properly balanced and the disease is prevented. Other examples of disease due to food faults of various kinds were afforded by scurvy, rickets, certain diseases of the eyes, lungs and gastro-intestinal tract, severe anaemias, and other

diseases associated with softening of the bones which give rise to much suffering amongst purdah women and their children in certain parts of India. An experiment was made which consisted in feeding two groups of monkeys with the same foods, but whereas one food was given in its natural state, the other was fed after the vital factors (vitamins) had been in great part destroyed by subjection to a temperature of 1,300° C. for two hours. Both groups of monkeys were found to be "carriers" of the organism which causes dysentery, but while the second group, fed on devitalised food acquired the disease, the first group was free from it.

Experiments showing the importance of certain minerals such as lime, phosphorus, iron, iodine, manganese, &c., have also been carried out. Deficiencies, for instance, in the amount of fats or of lime and the amount of iodine in foods might result in thyroid gland disease. Growth in man, on the other hand, has been found to be influenced by manganese.

Colonel McCarrison is of the opinion that the newer knowledge of nutrition has demonstrated that many kinds of diseases resulted from certain deficiencies in the food deficiencies of vitamins or mineral salts, or of proteins, either absolute or relative to other food essentials. Further, by the use of faulty or ill balanced foods, the tissues of the body were rendered susceptible to invasion by bacterial and other disease producing agencies.

A perfectly constituted food, according to Col. McCarrison was provided by the following ingredients, whole meal flour, or other whole cereal (rice, cholam, cumbu, &c.), milk, milk-products, eggs, sea-foods (fish), green leafy vegetables and fruit in abundance with meat occasionally. So long as a sufficiency of each of these was taken in proper proportion man had little to fear from disease resulting from malnutrition. Meat, while useful in moderation, was an unnecessary addition to man's food provided he used enough milk and curds which afforded the best of all known proteins and much else besides of high nutritive value. The difficulty in India was that there was not enough milk and milk-products "to go round."

The Colonel has also demonstrated the agricultural bearing of his work by showing with the help of charts the results of experiments of the effect of soil, manure and irrigation on the nutritive quality of food grains, and the manner in which the prevalence of certain diseases—such as beri-beri was determined by agricultural practice. Thus in the East Coast Districts of the Madras Presidency which is the endemic home of beri-beri in India, it was shown that the endemicity of the disease was largely determined by the cultivation of rice to the almost complete exclusion of supplementary foods which must be eaten with the rice, if nutritional needs are to be adequately served.

SUGAR IN FIJI.*

Evolution of the Industry from the point of view of the labour engaged in producing cane.

WITHIN the past fifty years the sugar industry in Fiji has passed through many vicissitudes. In the late '70's it was represented by a number of small factories dependent for their supplies of cane on the lands in their immediate vicinity, but in the stress of world competition, which culminated in the sugar crisis of 1884 the majority of these disappeared and their places were taken by larger central factories which drew their supplies from wider districts served either by rail or water transport. The cane was grown on estates operated by Companies owning the mills or by European planters under agreement with the former for the sale and purchase of their crops.

At the outset the labour was either native or imported from other Islands in the South Seas and indentured to the planters for periods varying from one to three years. The supply of such labour, however, was somewhat precarious, and in the early '80's the Colonial Government began the introduction of agricultural labourers from India under conditions agreed upon between the Colonial Office in London and the Government of India. These immigrants first came from the Ganges Valley with a sprinkling from other parts of India, but in later years a considerable proportion consisted of Madrassis and other Southern races.

The period of enagagement was for five years, during which the immigrants, while learning the trade of agriculture under the conditions of their new country, were secure of continuous employment at wages which enabled a large proportion to save money, and at the expiry of their indentures to take up small areas on lease from native or European owners on which to commence farming on their own account.

A few years before the war broke out an agitation arose in India against the continuance of this system, and in 1916, the Indian Government, ostensibly as a war measure, put a stop to further emigration under agreement, and later prohibited this by legislation, and at the end of 1919 all remaining indentures were cancelled by Ordinance of the local Government. Since then the industry for the wage labour required, has been dependent on the local supply, whether of Indians or natives, these being for the main part employed from day to day, though short time agreements are permissible under the Masters and Servants Ordinance.

For some years prior to 1916 the agitation above referred to had provided warnings of a possible stoppage of immigration from India and efforts had been made to render the local industry less dependent on a continuance of a supply of labour from overseas. The problem was a difficult one as the majority of the Indians

* The present article was received for publication from the General Manager of the Colonial Sugar Refining Company.

on the expiry of their agreements preferred the freedom of a life on their own small holdings to continuing to work for an employer. It was, however, attacked from several different angles;

By encouraging the small Indian farmers settled in the neighbourhood of the estates to grow canes.

By leasing portions of the estate to other time expired Indians for the purpose of cane growing.

By the adoption on the remainder of the estates of labour saving methods and appliances.

As a result of the steps taken in the direction of offering contracts for a period of years for the purchase of their crops and providing tramline facilities for the transport of the latter, also cash advances on easy terms repayable out of the proceeds of the crops, a rapid expansion took place in the areas cultivated by the independent settlers, and this has since become a very important factor in the supply of cane for the mills.

The second line of attack was the curtailment of the area for which wage-labour had to be found by leasing, to Indian farmers in small areas, those estates, or portions of estates, where wage-labour was most difficult to get. Various schemes of co-partnership were tried under which the estate owner and the labourers shared the work and the proceeds of the crops, but for different reasons these were gradually dropped in favour of straight-out leasing to individual tenants, and the system now generally current is to lease for periods ranging up to ten years small blocks on which the whole of the work can be performed by the tenant and his family so that each unit is independent of outside assistance excepting in the harvesting as hereinafter described. The estates in most cases belong to the Company owning the mill, who are naturally much more interested in securing a supply of cane for the factory than in obtaining high rentals for the land. For this reason the rents are kept low, and at the outset advances are given on the security of the crops to enable the tenants to carry on during the growth of the latter, while help is also given in the matter of the purchase of suitable implements, stock, manures, &c., and the result has been that in the course of the few years since this system became general a large proportion, well over 50 per cent. of the total area of the estates has been thus settled with men who have had a long apprenticeship at the trade of sugar growing. Such a system could of course be permanently satisfactory only if provision be made for the proper treatment of the land as regards the maintenance of fertility, and this it is thought has been secured by the terms and conditions of the lease. The observance of the latter however can be ensured only by very close supervision, though where this is given results have been achieved which are satisfactory to both sides, and the tenants—also the independent settlers—are found to appreciate the close attention and assistance given them by the Company's officials. The latter endeavour in every way possible, as by organising agricultural shows, ploughing matches, best-farm competitions, &c., to encourage the development of better farming methods and with very noticeable effect on the general farming practice.

To economise in the quantity of portable line required for the harvesting of the crops and to prevent undue competition amongst the growers for labour for this purpose a system has been worked out of organising the growers into co-operative groups, each member of which undertakes to work in the harvesting gang for a given number of days during the crushing season, the period being proportionate to the tonnage of cane to be harvested from his own farm. Each member of the gang is paid wages corresponding to the work done, whether it be on his own or on other farms, and the management of these gangs both in regard to work done and wages paid is under close control by the Overseer in charge of the district. The individual farmer is debited with the total cost of the work done by the gang on his farm and this is collected from the proceeds of his crop.

Under this sytem it is found that in a normal season the tenant farmer is able to save money and rapidly to pay off the indebtedness incurred when taking over his farm as a going concern. In these circumstances it is not surprising that there is a keen demand for the farms, but the system has its own disadvantages in that it attracts the best men from the estates with a consequent detrimental effect on the average standard of labour available for carrying on the areas that yet remain under the plantation system. Here, however, there has been a material reduction in the average number of labour required by means of the substitution of implements for hand labour in many of the operations formerly dependent on the latter. Horse drawn implements have to a large extent taken the place of hand labour, and in many cases the work formerly done by horse drawn implements is now performed by tractors, which latter represent a large saving in the number of labourers required. To such an extent has this change taken place that the total number of labour required per hundred acres cultivated has been curtailed from 30 to 40 per cent.

By the means above referred to the industry has been kept on its feet through a period when the stoppage of immigration from outside threatened to bring things to a standstill and the production of sugar bids fair to be maintained at a level at least as high as during the period before the system of immigration came to an end.

The following appointments were made by the Colonial Office in February :—

Mr. R. S. Kyle, M.R.C.V.S., Veterinary Officer, Tanganyika Territory.

Captain E. M. Nicholl, Manager, Kwamkoro Estate, Amani Institute, Tanganyika Territory.

TROPICAL WORLD NOTES.

New South Wales.

A large storage dam capable of holding 771,640 acre-feet of water was constructed by the New South Wales Government at the head of the Murrumbidgee river some years ago, for the purpose of irrigating large areas of suitable land two hundred miles lower down the river. The land was formerly used principally for fruit growing, but for the last few years experiments have been made in rice cultivation which has proved very successful and promises to develop into a profitable industry. It is stated that this year there are 11,000 acres under this crop, which it is estimated will yield from 13,000 to 15,000 tons of rice. The annual importation of rice into Australia is 25,000 tons. The Commonwealth Government has protected the new industry by the imposition of a customs duty of 3*s.* 4*d.* per (1) cental on uncleaned rice and 6*s.* per cental on other than uncleaned.—(*Commercial Intelligence Journal*, Vol. XXXVII, No. 1260.)

* * *

Bengal.

The third and final forecast of the winter rice crop of Bengal, 1927-28, shows that the total area under winter rice is 13,210,100 acres as against the revised figure of 14,148,300 acres in the final forecast last year, or about 8.6 per cent. less than last year.

Accepting 78 per cent. as the provincial outturn, the gross yield of the crop, on the basis of a normal yield of 12½ (2) maunds of clean grain per acre, is estimated at 4,731,400 tons this year as against the revised figure of 5,639,300 tons in the final forecast of last year, or about 16 per cent. less than last year.—(*The Planters Journal and Agriculturist*, Vol. VII, No. 5.)

* * *

Sudan.

Notwithstanding a bad harvest in 1926 and its effect on the country's capacity to absorb imports, the trade of the Sudan last year showed a further expansion, the total at (3) £E11,631,810, being an increase on the 1926 figures of 5.4 per cent.

Cotton, of course, overshadowed the export list. Shipments of this commodity increased by 149,257 (4) kantars, the value of the trade being £E3,200,251, as compared with £E2,845,702 in 1926. There was also a substantial increase in the value of cotton-seed exported. Minor increases took place in senna, dates, and hides, but other products showed decreases, particularly pronounced declines taking place in gum, ground-nuts, sesame, dom palm nuts, cattle and sheep.—(*The Chamber of Commerce Journal*, Vol. LV, No. 737.)

1.—Cental = 100 lb. average.
2.—Maund = 100 lb. troy.
3.—£E = £1 0s. 6d.
4.—Kantar = Egyptian pound or pounds.

Honduras.

The American Consul at Tegucigalpa reports that banana companies in Honduras enjoyed a prosperous year in 1927, more than 19,000,000 bunches of bananas being produced and exported—the record shipment was 19,200,000 bunches in 1918. Exports of bananas showed a seasonable increase in December over November, and 1,114,850 bunches were exported to the United States, and 187,037 bunches to England. The prospects for 1928 are very good, notwithstanding the fact that the banana areas are subject to torrential floods and severe windstorms. The production of sugar has steadily increased since 1915, and in 1927 over 60,790,000 lb. were produced, as compared with approximately 31,000,000 lb. in 1926. (*The Chamber of Commerce Journal*, Vol. LV, No. 737.)

* * *

Leeward Islands.

During the year 1926 the total imports into the Colony of the Leeward Islands, according to the latest annual report (No. 1371, H. M. Stationery Office, Kingsway, London, W.C.2, price, 1s. net.), were valued at £842,464 (£786,558 in 1925), of which the United Kingdom furnished £229,236 and other parts of the British Empire £367,496. Of the exports which were valued at £689,113 (£727,862), the United Kingdom took £250,023 worth, and other parts of the British Empire £308,271.

The sugar cane crop of Antigua fell considerably short of 1925 (total output of vacuum pan sugar was 12,196 tons), but although the cotton crop also was unsatisfactory, shipments of lint increased considerably in consequence of a larger area devoted to cotton. A large advance took place in exports from Antigua of lime products. An increase of 727 tons was shown in the St. Kitts-Nevis crop of grey crystal sugar, and exports for the year were 15,651 tons grey crystals, 19,309 gallons fancy syrup and 377,913 gallons factory molasses; the cotton crop totalled 348,697 lb. of lint, and the number of coconuts exported was considerably in excess of 1925 shipments.

The lime industry of Dominica was affected by a severe storm in 1926, and exports of limes decreased by some 16,000 barrels; 73 per cent. of the lime crop is devoted to production of concentrated juice, and exports of products of the lime industry totalled £87,555 in 1926. Owing to favourable conditions, the Sea Island cotton crop of Montserrat was above the average, and exports amounted to 600,217 lb. of lint; onion cultivation in this presidency received a big impetus, and over 400,000 lb. of onions were exported; minor products, mostly fruit, show marked development. As regards the Virgin Islands, the year under review was one of exceptional drought, and all crops suffered to a large extent.—(*The Chamber of Commerce Journal*. Vol. LV, No. 736.)

Southern Rhodesia.

The Acting High Commissioner for Southern Rhodesia has been advised by his Government that the remarkable progress enjoyed by the Colony is being well maintained and for the first month of the year the following striking figures have been furnished as representing the preliminary statistics for the summer crops of 1927 :—

	Acres planted.	*Crop yield.*
Maize	267,000	1,659,000 bags. (of 200 lb.)
Tobacco	30,000	19,175,000 lb.
Ground-nuts ..	8,000	66,000 bags (of 80 lb.)

These figures represent the largest ever recorded in the Colony. The estimated total value of the crops is £1,350,000 shared amongst 3,000 farmers. During the month of January, 1928, new settlers numbered 555, which constitutes a "record." Farming prospects in Southern Rhodesia are stated on the highest authority to have improved 100 per cent. during the last five years. The rainy season, up to the present, has been most favourable, and excellent crops are assured.

* * *

Gold Coast.

Mr. J. H. Thomas, M.P., opened on the 3rd April the Takoradi Harbour in the presence of the Governors of the Gold Coast and of Sierra Leone and a large representative company.

Built at a cost of £3,300,000 by the Gold Coast Government, the harbour is the only complete shelter for ships on the 1,300 miles of surf bound coast between Sierra Leone and Nigeria. The main and lee breakwaters, 1½ miles and ¾ mile long respectively, enclose 270 acres, in which some 12 ships can lie in the roughest weather in calm water up to 40 feet deep. Three alongside wharves for ships of 400 feet length and 30 feet draught have been provided and can be increased to six when required. The whole harbour is well supplied with railway and modern equipment capable of handling 5,000 tons of cargo a day, while ample and convenient facilities exist for doubling the size of the port.

The harbour is the crowning feat of a notable development of communications, as since it was first designed over 240 miles of railway and 4,000 miles of motor road have been added to the trade routes of the Gold Coast, thus trebling in seven years the trade and revenue of a small Crown Colony. This rapid development has been achieved to cope with the increased output of manganese and the agricultural products of the Northern territories and with the opening of the great bauxite fields of Sefwi. Takoradi, situated 3,750 miles from London and 4,551 miles from New York and as the terminal port to the present extensive system of land routes in the Colony, should very much consolidate the position of the Gold Coast in the markets of the world.

Tanganyika.

Recent crop reports for January and February received through the courtesy of the Tanganyika Department of Agriculture indicate that owing to lack of rain in most of the districts, the planting of crops has been delayed and that in some cases growing crops have suffered seriously from drought. Wherever the rain has fallen, however, the crop prospects are brighter. A large maize crop is expected in Usambara, while rice will probably yield better than last year in Songea. Coffee thrips have appeared in Moshi.

* * *

Round East Africa.

THE following news items of interest are reprinted from *The East Africa* information bureau column.

Northern Rhodesia is to spend about £30,000 on road improvements during the current year.

* * *

The Uganda cotton tax has been fixed at 6 cents of a shilling per pound for the 1928 season.

* * *

Of the 15,502 bags of coffee exported from Kenya during the last week in January, 14,795 were shipped to England.

* * *

Seven European rubber and coffee estates in Uganda which had lain derelict for years past are reported to have been re-opened during 1927.

* * *

Exports from Kenya and Uganda during the last week in January included: Coffee, 15,502 bags; hides and skins, 1,144 bales; maize 9,063 bags; and sisal and sisal tow, 9,132 bales.

* * *

The Buganda Seed Cotton Buying Association has invited the British and Native Governments of Uganda to appoint representatives to the Rate Fixing Committee of the Association.

* * *

Several cotton ginneries in Uganda have recently changed hands. The Ngogwe ginnery has been purchased by the Liverpool Uganda Company for £6,375; that at Luwero by the Nakasero Trading Company for £3,500; two at Kidzi River and Kyoko (Kaboyo) by Narandas Rajaram and Company (Africa) Ltd. for £4,000 and £2,050 respectively; and that at Kyabakuzn by Jamal Ramji and Company for £3,750.

* * *

Tanganyika's imports during the first ten months of last year totalled £3,001,990, as against £2,671,453 in the corresponding period of 1926. The fact that Great Britain's proportion was decreasing and that of Germany increasing on which we have previously commented, is again demonstrated. Whereas in 1926 Great Britain's proportion for the first ten months was 40 per cent. and that of Germany 9 per cent. the returns show that for 1927 the proportion of Great Britain had dropped to 38 per cent. and that of Germany had risen to 11 per cent.

CANE SYRUP EXPERIMENTS.

A SERIES of important experiments on the manufacture of high grade syrups directly from cane juice have recently been brought to a successful conclusion at the College Experimental Sugar Factory. These experiments were conducted with the co-operation of officials of "British Suchar Processes, Ltd.," who expressed themselves well pleased with the results of the experiments, and the suitability of the College factory for large scale experiments and practical demonstrations of new processes at a reasonable cost to all concerned.

Preliminary laboratory experiments were necessary to determine the best method for partial inversion of the syrup, degree of blending desirable for best flavour, and amount of carbon ("Suchar") required for the removal of excess of colouring matter.

The final syrup obtained in the factory is quite clear, has a light reddish-gold colour and density of over 80° Brix. It is confidently expected that it will neither crystallize nor ferment. The syrup is free from any added chemicals, apart from those used in the normal clarification of the cane juice, namely: lime and phosphoric acid.

Part of the syrup manufactured will be disposed of in tins of 2 lb. and 5 lb. size, in order to facilitate its distribution and the study of its suitability for different markets.

We consider that these experiments are of great importance to the sugar industry, particularly in those West Indian islands engaged in the production of cane syrups for export. Further particulars will be gladly supplied to anyone interested, on application to the Imperial College Department of Sugar Technology through the Editor of *Tropical Agriculture*.

BRITISH GUIANA JOURNAL.

WE have to acknowledge with thanks the receipt of the 1928 March issue (Vol. 1, No. 1) of *The Agricultural Journal* of British Guiana. The Journal (price 6*d*.) is published quarterly and can be obtained from the office of the Department of Agriculture, Georgetown, British Guiana. The first number of 68 pages contains seven original and two selected articles on topics which should be of great interest to agriculturists throughout the Colony, and to readers of agricultural subjects in other parts of the world. The leading article is by the Director of Agriculture, Professor J. S. Dash, B.S.A., on the Agricultural Organisation of British Guiana. The Editorial Committee are to be congratulated on the high standard of their first publication, and we wish the Journal every success in the future.

"ADCO" MANURE.

Its Composition in Trinidad.

BY F. HARDY AND G. RODRIGUEZ.

(*From Proceedings of the Froghopper Investigation Committee, Part* VII, 1927, pp. 196-201.)

IN the Report of the Agricultural Sub-Committee for Froghopper Investigation (dated 13th November, 1925) (*Proceedings*, Pt. I, p. 15, para. 3), it was recommended that 20 tons of "Adco" mixture be obtained for trial on estates. This recommendation was based on a general agreement amongst sugar-cane agriculturists that the "Adco" process offered great possibilities as a means of dealing with cane-trash for the purpose of providing suitable organic manure for addition to soil. Before the end of April, 1926, a consignment of "Adco" mixture was received in Trinidad. Two tons of it were immediately used at the St. Augustine Experiment Station for making a manure heap from cane-trash. The rest was distributed amongst various estates. Later in the year (October, November, 1926) several estate "Adco" manure heaps were inspected, and in many instances, it was advised that the heaps be turned by forking to promote further fermentation.

In December, 1926, instructions were issued to estate managers as to the best means of sampling "Adco" manure heaps for chemical examination. The first sample for analysis was received (from the Manager of the St. Augustine Experiment Station) on 20th December, 1926. Since then, 9 other samples of "Adco" manure have been received from various estates. In addition, 3 samples of ordinary pen panure, and 3 samples of vegetable raw materials have been received.

All these samples have been analysed for (*a*) moisture content, (*b*) ash, (*c*) total organic matter, and (*d*) total nitrogen. In addition, they have been quantitatively examined for *degree of humification* by a method involving the use of hydrogen peroxide, as devised by Prof. G. W. Robinson of the University College, Bangor, North Wales (*J. Agr. Sci.*, Vol. VII, Part I, January, 1927, pp. 104-108). It is maintained by the present writers that no analysis of organic manure is complete without some statement as to its content of true colloidal humus, because it is believed that this component is the "active" ingredient which confers on the manure most of its valuable properties. The hydrogen peroxide method enables one to estimate the content of colloidal humus. Organic manures should not be assessed solely on their contents of nitrogen and mineral matter, because these components can usually satisfactorily be supplied in the form of fertilizer salts.

Notes:

(1) "*Apparent*" *degree of humification* is the percentage loss in weight of the raw material or manure on treatment with hydrogen peroxide. This re-agent, containing as it does, a large proportion of

water, will leach out soluble substances, such as certain carbohydrates and salts. Such soluble substances are not attacked by hydrogen peroxide, but merely removed in aqueous solution.

(2) *"Actual" degree of humification* of a manure is its "apparent" degree *minus* the "apparent" degree of the raw material used in its preparation.

(3) It will be observed that the actual degrees of humification of the samples analysed vary considerably. They are reflected in the appearance of the manures. Those manures which exhibited darkest colours, in general, possessed the highest degrees of humification, and, presumably will, exert the most beneficial results when applied to soil.

The following table represents the results of analyses performed by one of us (G.R.) :—

TABLE I.

	Raw Material.	Date heap was made.	Date of Sampling.	Fresh Material.				Oven-Dried Material.			Degree of Humification.	
				Moisture Content.	Total Organic Matter.	Ash Content.	Total Nitrogen.	Total Organic matter	Ash Content.	Total Nitrogen.	Apparent.	Actual.
I.—Raw Materials.				%	%	%	%	%	%	%	%	%
1. Sugar-cane trash (air-dry)	—	—	—	15.42	75.57	9.01	0.95	89.35	10.65	0.98	19.3	—
2. Sugar-cane megass (air-dry)	—	—	—	9.00	85.00	6.00	0.44	93.44	6.59	0.48	35.5	—
3. Fresh Bamboo grass	—	—	—	79.24	18.21	2.55	0.39	87.74	12.26	1.77	40.0	—

TABLE II.

II.—Pen Manures.				%	%	%	%	%	%	%	%	%
1. St. Aug. Expt. Sta.	Trash	—	Dec. 20, 1926	71.65	15.85	12.50	0.58	55.91	44.09	1.97	67.8	48.5
2. Waterloo Estate	Trash	—	Feb. 2, 1927	76.85	12.92	10.23	0.57	55.81	44.19	2.48	39.5	20.2
3. Waterloo Estate ("Mauritius" pen)	Chopped cane tops	—	Feb. 2, 1927	78.10	15.76	6.14	0.59	71.97	28.03	2.70	49.1	?

TABLE III.

III.—"Adco" Manures		1926	1927	%	%	%	%	%	%	%	%	%
1. Waterloo ..	Trash	June 23,	Feb. 16,	78.46	13.68	7.86	0.49	63.51	36.49	2.27	58.6	39.3
2. St. Aug. Expt. Sta.	Trash	May 20,	Dec. 20, 1926	74.03	16.77	9.20	0.57	65.39	34.61	2.14	58.2	38.9
3. U.S.M., Williamsville	Trash	July 20,	Jan. 15,	70.25	14.76	14.99	0.52	49.61	50.39	1.75	53.1	33.8
4. U.S.M., Union Hall	Trash	July 9,	Jan. 15,	76.30	15.84	7.86	0.49	66.84	33.16	2.06	37.8	18.5
5. Brontë ..	Trash	—	Jan. 28,	78.13	11.65	10.22	0.44	53.27	46.73	2.00	37.6	18.3
6. Waterloo, Wyaby	Trash and grass	Oct. 11,	Feb. 12,	81.75	12.65	5.60	0.38	69.32	30.68	2.08	45.9	16.3
7. Caroni ..	Bamboo grass	July 15,	Feb. 4,	75.70	12.34	11.96	0.75	50.78	49.22	3.09	54.7	14.7
8. Waterloo ..	Megass	June 9,	Feb. 16,	80.71	13.81	5.48	0.33	71.64	28.36	1.71	41.1	5.6
9. Waterloo, McBean	Trash and grass	Oct. 15,	Feb. 24,	73.48	15.27	11.25	0.74	57.58	42.42	2.80	32.5	2.9
10. La Vega (Cacao Estate)	Grassand roughage	Feb. 5,	Feb. 4,	82.98	9.26	7.76	0.40	54.41	45.59	2.37	21.7	?

(4) The "Adco" manure made from *megass* showed a relatively low degree of actual humification. It had hardly broken down at all. Megass and similar materials probably need special treatment in order to convert them into useful organic manures. The subject is receiving special study, and will be discussed by us on a future occasion.

(5) The *fresh grass and herbage manures* showed lower degrees of humification than was suggested by their appearance. Perhaps their tardy break down was due to the raw material not having been allowed to quail and die before stacking(1). Evidently the manufacture of "Adco" manure from fresh green material in Trinidad requires further investigation.

For purposes of comparison, some analyses of "Adco" manures, published in literature, are appended. (Table IV.)

TABLE IV.

RAW MATERIAL.	FRESH MATERIAL.				OVEN-DRIED MATERIAL.		
	Moisture Content.	Total Organic Matter.	Ash Content.	Total Nitrogen.	Total Organic Matter.	Ash Content.	Total Nitrogen.
IV.—"ADCO" MANURES: OTHER EXAMPLES.	%	%	%	%	%	%	%
"Adco" Trinidad —Dry grass	77.38	15.76	6.86	0.51	69.67	30.33	2.25
"Adco," Rhodesia —Fresh Veldt grass (2) ..	72.90	15.48	11.62	0.54	57.12	42.88	1.99
"Adco," Rhodesia —Dry Veldt grass (2) ..	81.10	12.37	6.53	0.42	65.45	34.55	2.22
"Adco," England —Hop-vines (3) ..	76.9	13.4	9.7	0.41	58.0	42.0	1.78

(1) Mr. F. Hannaford Richards records a similar observation in his description of the manufacture of "Adco" manure from hop-bines (*Brewers' Journal*, 15th February, 1927). He explains the fact that a hop-bine heap made of *fresh green material* failed to break down satisfactorily because too high a temperature was reached during the first week. This high temperature may have partially sterilized the heap, as well as lowered its water content below the optimum. Furthermore, it may have destroyed the more decomposable carbohydrates essential as food for the organisms that can break down the more resistant parts of the material.

(2) "Adco" literature.

(3) *The Brewers' Journal*, 15th February, 1927.

SUGAR IN 1927.

WHEN the market opened in January the prices then ruling were 16*s.* for Cubas and Peruvians and 19*s.* 9*d.* for B. P. West Indian sugars, all per cwt. *c.i.f.* A large speculative business had been developed in all markets in expectation of a further improvement in values. These sanguine expectations were not realised. A sluggish demand was experienced during the next two months, resulting in a decline from 1*s.* to 6*d.* per cwt. Early in March there was a temporary interest on Canadian and Continental demand for Cuban and Domingo sugars, one of the Domingo cargoes being taken by Italy at 15*s.* 6*d.* *c.i.f.* During April and May the market was fairly steady at 14*s.* 3*d.* to 14*s.* 6*d.* for Cubas and 18*s.* 3*d.* to 18*s.* 6*d.* for B.P. West India, but in June great dullness prevailed early in the month. There was little change in the market during July and the first days of August, quotations ranging from 13*s.* 3*d.* to 12*s.* 10½*d.* for Cubas and Peruvians and 16*s.* 7½*d.* to 16*s.* 4½*d.* for B.P. West India. There was no great change in quotations during September, the value of Peruvians ranging from 13*s.* to 13*s.* 6*d.* *c.i.f.* and of B.P. West India at 16*s.* 6*d.*

In October the Cuban Restriction Bill, in charge of Col. Tarafa, was signed by the President. On the passing of this Bill Cuban quotations were at once raised to 2⅞ cost and freight, New York. The business to refiners in October was confined to Peruvians at 11*s.* 10½*d.* to 12*s.* and to B.P. West India at 15*s.* to 15*s.* 6*d.* *c.i.f.* as Cubans had for the time being gone beyond reach. The Cuban Presidential Committee then resolved to relieve their market of 150,000 tons of their unsold Cubans, and they were successful in making an immediate sale to Messrs. Tate and Lyle of this quantity at about 11*s.* 7½*d.* *c.i.f.*, a larger sale having never formally been made in one line. This purchase enabled these buyers to compete successfully with home-grown sugars, and prevented the temporary closing of their works.—(*The Economist*, Vol. CVI, No. 4407.)

COTTON NOTE.

The Perennial Cultivation of Cotton, with Special Reference to the Cultivation of Ratoons in Egypt.

BY DR. JAMES TEMPLETON.

Technical and Scientific Service. Bull. 75. Ministry of Agriculture, Egypt, 1928.

IN this paper the author brings together the evidence relating to the perennial cultivation of cotton in various parts of the world, and describes the experimental work which he has carried out in Egypt. His investigations are the first real scientific ones that have so far been reported and will go far to induce a rational attitude towards the practice of ratooning. Reviewing the literature on growing perennial cotton, in which the lack of experimental evidence is only equalled by the frequency with which generalisations have been put forward, the author sums up by emphasising the fact that the whole subject of the perennial cultivation of cotton is one about which very little is known, and one which is worthy of serious scientific investigation.

The experiments were exhaustively carried on for five years, and particular attention was paid to the yield and quality of the crop, and the damage from insect pests. A summary of the results obtained is as follows :—

1. The crop from ratoons arrives much earlier—up to six weeks than the crop from first year plants.
2. The yield was higher than that of first year plants, with two exceptions, one of which could be accounted for.
3. The yield in the north of the Delta with Sakel from ratoons was remarkable, being on one Estate at least twice that ever obtained from first year plants.
4. There is no evidence that the quality of the staple deteriorates after the first year. On the contrary it was often found that the ratoon cotton was of a higher class than that from first year plants, with consequently a higher market value.
5. Second pickings from ratoons are almost invariably better in quality than second pickings from first year plants.
6. Ratooned plants suffer less damage from insect pests and are unable to carry the insect pests of Egypt over to the next year.

As a result of this work, the author recommends that ratooning should be tried in new areas where the yield is found to be low.

These experiments confirm what many intelligent planters have thought for a long time, and the present writer argued in the pages of this Journal (*Trop. Agr.* Vol. 1, No. 7, July, 1924) that ratoon cotton had many advantages in Tropical countries where there was a difficulty in obtaining a stand. Even at that time it was clear that planters in Brazil and Peru where empirical knowledge of cotton growing is of long-standing, would not grow perennial cottons without good reason. The reason for most agricultural practices of this type is that they have been found to pay.

There are two points to be considered : first it is absolutely essential that cleaning up of the fields of dead bolls should be thorough, otherwise in the Tropics the Pink Boll worm would be certain to give trouble, as well as the cotton stainer, and second, a type of plant must be chosen which will tolerate ratooning. The fruiting habit of Egyptian cotton lends itself to a perennial existence to a much greater extent than that of Upland cotton, and as new ventures in cotton growing are for the most part confined to the latter type, it will be necessary to breed an Upland with bigger vegetative zones—a semi-monopodial Upland in fact. In Trinidad, some third generation hybrids between Upland and *G. purpurascens* would seem to provide something like the type required. The synthesis of such a type in a pure state offers no difficulties whatever, since we are no longer oppressed by the bogey of hybrids. Egyptian cotton, in the writer's experience is inordinately susceptible to Black Arm in countries which depend on rainfall for growing cotton, and we now know enough to avoid growing it, until the Black Arm resistance of Sea Island in some of its forms is put into it. A new type of Egyptian cotton capable of being grown as a perennial in rain countries, and with a staple like Jannovitch would seem to have a considerable future.

It might be as well to emphasise in closing that growing a perennial cotton is a matter for adequate supervision by good agriculturalists, and it would be risky to encourage it in the Tropics as a practice for native cultivators. Those who have seen left-over cotton (often confused with ratoon cotton) in the West Indies, and have realised the trouble it can give as a breeding ground for stainers will strongly support this statement.

Ratoon cotton does not mean cotton which has just been left to itself. It means cotton which has been carefully pruned, cleaned up, manured and cultivated—all at the right time. The writer fears that in many countries the cotton would receive the former treatment rather than the latter.

S. C. HARLAND.

THE following appointments have been made by the Secretary of State for the Colonies during the month of March, 1928 :—

Mr. S. Gillett, C.D.A., Assistant Agricultural Officer, Kenya.

Mr. W. H. W. Baird, M.R.C.V.S., D.V.S.M., Entomologist, Veterinary Department, Tanganyika Territory.

Mr. R. R. LeGeyt Worsley, B.SC., A.R.C.S., D.I.C., PH.D., Chemist, Amani Institute, Tanganyika Territory.

Mr. G. Milne, M.SC., Soil Chemist, Amani Institute, Tanganyika Territory.

Mr. J. T. Templer (Administrative Cadet, Tanganyika Territory), Assistant Conservator of Forests, Uganda.

MYCOLOGICAL NOTE.

Some conditions influencing the development of bacterial disease of cotton (Bacterium malvacerum), by W. P. K. Findlay, B.SC., A.R.C.S.

THE note is a summary of some work which the author carried out, at the Imperial College of Tropical Agriculture (1926-27), in an attempt to determine some of the conditions influencing the development and spread of the disease (particularly the Black Arm phase) caused by *B. malvacerum*.

The author describes the results obtained in experiments carried out deliberately to affect the metabolic condition of the plant. Amongst the measures taken to accomplish this were (i) Ring barking, (ii) Different degrees of water-logging, (iii) Manuring and (iv) Grafting. The author's conclusions are as follows:—"Throughout the work it is from the point of view of the condition of the plant that the development of the disease has been considered, but the possibility of variations in the other organism (*i.e.* of the bacterium causing the disease) must not be overlooked. Re-isolations of the bacterium were made from time to time and tested out against the original, but showed no great variation in infective power. It is, of course, possible that different strains of the bacterium may exist in different localities, and this may explain the variations in the severity of attack on the same variety of cotton in different places, but we have no evidence on this point. While resistance to this disease seems definitely heritable, and many species and varieties are more or less completely resistant, yet it seems from the results above described, that the susceptibility to attack and the severity of the attack may be largely influenced by external factors in the environment of the plant.

An experiment that was performed to test the effect of artificial manures on the resistance of the plant gave results that suggested that the addition of quantities of nitrogen (in this case ammonium sulphate) to the soil definitely increased susceptibility. From this and from the results of the experiments on ringing, together with the fact that it is always the youngest leaves on a plant that take the attack worst, it may be concluded that it is the vegetative nitrogenous immature type of plant that is most liable to the disease. Probably, therefore, any operations, cultural or otherwise, which tend to bring earlier maturity would lessen the trouble from the disease.

The question of the spread of the disease in the field is quite an open one, and it may possibly prove not to be of great importance; isolated patches of badly infected plants may sometimes be seen in an otherwise healthy field.

The transmission of the infection internally in the seed has been definitely established by Archibald, so the necessity for sowing seed absolutely free from infection becomes of great importance, for the bacteria within the tissues of the seed cannot be killed by any methods which will not at the same time injure the seed. External sterilization can at the best be only partially successful, but may be useful for other reasons.

A wet or water-logged soil appears definitely to encourage the progress of the disease, and this is one more reason for growing cotton only on land that is perfectly drained. In irrigated land also it is of extreme importance to have a satisfactory drainage system. The work of Balls has shown the disastrous effects of a rise in the water table from other points of view. The cotton plant has always been known to be most sensitive to any alteration in its soil water relations, and these seem to have an important effect also on its resistance to disease."

H. R. B-J.

RHODESIAN SETTLERS.

THERE are now in force three approved schemes of settlement in Southern Rhodesia under the Empire Settlement Act. Under Scheme "A" which applies to persons from the United Kingdom possessing, if unmarried, between £900 and £1,500 or, if married, between £1,000 and £2,000, assistance towards passage is given and training in agriculture under experienced farmers is provided on the completion of which a suitable farm is allocated to the settler by the Government. Only 300 persons sailing for Southern Rhodesia during the period ending 31st March, 1931 will benefit by this scheme. Under Scheme "B" settlers with not less than £200 will be accepted, but they must be under thirty-five years of age, and should have (1) at least two years experience of practical agriculture, or (2) be jobbing artisans with a knowledge of bricklaying, carpentry, &c. They should be prepared to undergo a period of twelve months training in local agricultural conditions, after which they will be given employment or can take up land on their own. The third scheme is one of nomination by which persons already holding and farming land in Southern Rhodesia will undertake to find suitable accomodation and at least one year's employment for the nominee, his wife and family. The nominee need not be an agriculturist but must agree to engage himself in agricultural employment with the nominator on arrival in Southern Rhodesia. Further details of these schemes can be obtained from the Secretary, Office of the High Commissioner for Southern Rhodesia, Crown House, Aldwych, London, W.C.2.

ACCORDING to recent statistics published by the Cuban Chamber of Commerce, American capital invested in Cuba is estimated at $1,505,000,000, a figure which is believed to be higher than the total of American capital advanced to any other Latin-American country. Of this money $800,000,000 or over half of the total is invested in the Cuban cane sugar industry which controls about 80 per cent. of the world's output of this product.—(*The Financial News.*)

RUBBER RESTRICTION.

A CABLED report announces that the Stevenson Restriction Scheme applying to exports of rubber from Malaya and Ceylon will continue until 1st November and then cease. Further information is not yet to hand.

The difficulties of the rubber industry arise mainly from the fact that, unlike an annual crop, supply cannot rapidly be adujsted to changes in demand, and the industry has to forecast, not what production is likely to be profitable during the next year, with the possibility of adjusting errors of judgment in the succeeding year, but the profitable production level commencing five or six years ahead. Coupled with this is the fact that, while rubber has many uses, motor tyres absorb something like 75 per cent. of the total output, so that changes in this industry cannot find adequate compensation in alternative industries. Periodically, therefore, price levels must inevitably indicate maladjustment of supply and demand, and one must anticipate in the future, as has been experienced in the past, periods of exceptionally high or low prices.

Such a maladjustment occured in 1921 when prices fell below the cost of production due to the world wide slump in which the motor industry was involved, and the widespread use of the high pressure cord tyre with its longer life. An attempt was made to enlist all rubber producers in a scheme for temporarily reducing tapping until prices were raised to a level affording a reasonable profit without stimulating extensive planting. Dutch interests declined to participate and the Stevenson Scheme was therefore confined to British Malaya and Ceylon with the voluntary co-operation of British and other interests elsewhere. At that period British Possessions produced approximately 73 per cent. of the world's production.

It must have been clear that, since British producers possessed no monopoly, restriction below optimum output could be regarded only as a temporary expedient, though the machinery might have been retained as a 'safety valve.' It was therefore essential that the basic price upon which the degree of restriction would depend should be fixed at a level affording a profit only to those estates reaching a reasonable standard of efficiency.

Eventually 1*s.* 3*d.* a lb. was determined as the pivotal price, and while this might be criticised as a little too high, in view of the non-co-operation of Dutch interests, it nevertheless represented a reasonable average. The scheme succeeded in raising prices to a profitable level, but it failed signally to secure stabilisation. Fluctuations were inevitable since the scheme took cognisance only of the trend and not of recognised seasonal variations in demand. The percentage of restriction applied not to the period of prices upon which it was based, but to the succeeding quarter during which different seasonal conditions obtained. By modifying the percentage according to the seasonal nature of demand during the quarter in which it was effective the more violent fluctuations might have been modified.

In addition the scheme itself lacked stability. In 1925 the use of the balloon tyre with its increased demand for rubber became fairly general. In April, 1926, the pivotal price appears to have been raised to 1*s.* 9*d.* The reasons for this change are unknown to the writer but it appears unjustifiable and fatal to the success of the scheme which depended upon maintaining a price which, while profitable to efficient producers, would not encourage accelerated planting and alternative wild or reclaimed sources of supply. Supplies from British sources have been reduced from about 73 per cent. in 1921 to about 55 per cent. in 1927 (or 52.5 per cent. from the restricted areas). This has greatly decreased the effect of restriction and the attempt to maintain over a long period a price of 1*s.* 9*d.* per lb. from sources supplying less than 60 per cent. of the world's total was not only unreasonable but also impossible. Under these changed circumstances a break down of the scheme was inevitable.

To sum up, we may say that restriction could only be effective by a pivotal price affording a narrow margin of profit, and by maintaining the high percentage coming from the restricted areas. The object should have been to reach 100 per cent. output at the earliest possible date consistent with profitable prices. This object appears to have been abandoned by the adoption in 1926 of a new pivotal price of 1*s.* 9*d.* for which no justification can be advanced. While it is not true to say that the original scheme was a failure it is correct to say that the qualifications subsequently introduced rendered it ineffective.

The following table indicates the declining effect of restriction on prices, and the fact that, in spite of a price considerably above the first pivotal of 1*s.* 3*d.* per lb., exports were restricted to a level below 100 per cent. of standard production.

	Average Annual Export Percentage.	** Average Price.* s. d.
Before Restriction.		
1920	—	1 4
1921	—	0 10.50
1922	—	0 9.25
During Restriction.		
1923	61.25	1 3.27
1924	57.08	1 1.79
1925	67.08	2 10.92
1926	95.42	1 11.73
1927	64.17	1 6.55

C. Y. S.

* Ribbed Smoked Sheet per lb., Spot, London.

The Secretary of State for the Colonies has been pleased to appoint Mr. R. A. Altson (Assistant Botanist and Mycologist, British Guiana), Assistant Mycologist, Department of Agriculture, Federated Malay States and Straits Settlements.

RUBBER IN 1927.

IN their *Review of the Rubber Market for* 1927, *Messrs. Symington and Sinclair* report the year a difficult one. Uncertainties regarding the future of Restriction were largely responsible for long periods of inactivity alternated by occasional periods of extreme activity. Prices varied from 1/8½*d.* in March for Ribbed Smoked Sheet Spot, to 1/3¾*d.* in September. Recovery followed the announcement, at the end of October, that Restriction would be continued and prices stood at 1/8 on 31st December. The American Rubber Pool is believed generally to have assisted the market by steadying prices.

The World's consumption of rubber has risen from 408,000 tons in 1922, the first year of Restriction, to 581,000 tons in 1927, the difference of 173,000 tons representing a cumulative annual increase of 7½ per cent. Disappointment was felt at the small quantity of rubber used by America, which showed an increase of only 1 per cent. over 1926, and at her percentage of the world's total consumption which fell from 67¼ per cent. in 1926 to 64 per cent. the falling off being mainly attributable to the Ford change over to their new car model. The total output of new cars in the United States of America and Canada declined from 4,464,541 to 3,571,921 but 1928 is expected to establish a new record. Germany and Europe show a remarkable increase in rubber consumption amounting to 15,000 tons.

The *Review* gives detailed accounts and statistics of the consumption and production of rubber in the chief countries of the world for 1927 and 1928 and supplements this information by an account of the motor and tyre industries in the United States of America and the United Kingdom.

The following estimates of total world production and consumption are given:

	Tons. 1927	*Tons.* 1928
Total World production	614,000	584,000
Do consumption....	581,000	625,000

All calculations of production during the current year were based on the assumption that Restriction of exports would continue at least till the end of 1928.

As Restriction is now to be abolished from 1st November of this year, *Messrs. Symington and Sinclair* have issued revised estimates of both the Production and Consumption of Rubber for 1928 in a pamphlet which has just come to hand. Although free shipments will not be possible till November it is certain that many of the estates and specially native owned areas will start full tapping at once and store their rubber for export in November. No very marked increase is likely to occur in consumption but a certain amount of reclaimed rubber will probably be replaced by raw rubber and it is estimated that the United States of America will increase her consumption of raw rubber from 390,000 tons to 420,000 tons. The world's revised production for 1928 is put at 667,800 tons, and the world's revised consumption at 655,000 tons.

REVIEWS.

CO-OPERATIVE MARKETING OF AGRICULTURAL PRODUCE IN ENGLAND AND WALES. Ministry of Agriculture and Fisheries. His Majesty's Stationery Office, London. pp. 195.

This is the first report of the Series reviewed in *Tropical Agriculture*, Vol. IV, No. 12, p. 237, and constitutes a survey of the present position of Co-operative Marketing of Agricultural produce in England and Wales. The first three chapters are explanatory and historical. Other chapters deal with particular products tracing in each case the development and giving an account of a particular society as illustration.

C. Y. S.

* * *

REPORT OF THE HARVARD BOTANICAL GARDENS, Soledad Estate, Cienfuegos, Cuba (Atkins Foundation). 1900-1926. By Robert M. Grey. Harvard University Press, Cambridge, Mass., 1927.

The Harvard Botanic Station for Tropical Research and Sugar Cane Investigation was formally inaugurated at Soledad in 1901, and Grey's Report is of the nature of a review of the work of a quarter of a century, with a more detailed report for the year 1926 appended.

An account is first given of the cane-breeding work and then the building of the botanical collection is described, followed by meteorological notes, descriptions of the older trees in the arboretum, and accounts of the fruit and palm collections, forage trials, and experiments in vegetable cultivation.

Thus quite a wide range of interest is covered, and every section contains information likely to be of use to experimenters elsewhere.

E. E. C.

* * *

YEAR BOOK OF AGRICULTURAL CO-OPERATION IN THE BRITISH EMPIRE, 1928. The Horace Plunkett Foundation. George Routledge & Sons, Ltd., pp. v + 456. Price 10*s.* 6*d.*

This Year Book, edited by the Horace Plunkett Foundation, should appeal to all interested in the many phases of co-operation. Special attention is given to those parts of the Empire which were not dealt with in the preceding volume, particularly England and Wales, Canada and South Africa. Of special interest to readers of *Tropical Agriculture* is the article on "Co-operation in Ceylon" by Mr. W. H. K. Campbell. One would like to see more attention devoted to the Crown Colonies where the problems which are capable of co-operative solution present many peculiarities. The book includes a survey of co-operative legislation, a bibliography and a statistical census. The census contains in a compact form an enormous mass of information which, owing to inadequate classification, is of doubtful utility.

C. Y. S.

ENZYMES, By Selman A. Waksman, M.S., Ph.D. and Wilburt C. Davison, M.A., M.D. Baillière, Tindall and Cox. London, 1926.

Enzymes are of interest to the biochemist, and to the physiologist and pathologist whose fields of research, whether centred on plants or on animals, adjoin and frequently overlap the biochemist's.

But beyond this they are also of great industrial and economic importance, and without listing their applications, mention of their rôle in the ripening of tobacco, the fermentation of cacao, and in the distillery will serve to indicate their significance to the tropical agriculturist. In fact wherever micro-organisms are employed in technological processes, there is need and scope for investigation of the enzymes concerned.

The volume under review will therefore appeal to research workers in a great variety of subjects. It is divided into four sections:—Properties of Enzymes; Distribution of Enzymes; Methods for the Preparation and Study of Enzymes; and Practical Applications of Enzyme Activity.

A work of this nature which ranges over the whole field of biology ("Life is just one enzyme reaction after another" as the authors say at the beginning of one chapter) is inevitably open to many criticisms. The plant physiologist is disappointed to find that "Enzymes of the Human and Animal Body" claim three times as much space as "Plant Enzymes," and the technologist to discover that the fourth section occupies only about one-twentieth of the volume.

Such criticism, however, is somewhat ungracious, and all users of the volume should be grateful to the authors, first for collecting into a concise form an enormous amount of scattered information, and in the second place for providing a bibliography of over thirteen hundred references.

E. E. C.

* * *

THE COTTON WORLD, John A. Todd, M.A., B.L., Sir Isaac Pitman & Sons, Ltd., pp. viii+236. Price 5s.

This is a collection, in book form, of lectures given to students at the City School of Commerce, Liverpool, since 1924. As a comprehensive survey, the compilation is well worth the attention of all interested in the cotton trade. In a chapter on "The World's Cotton Supplies." Professor Todd, an authority on cotton statistics, has written a useful survey, giving particular attention to the medium (American) cottons. It appears that of a total production of 28,664,000 bales of 500 lb. of all cottons in 1925-6, 28 per cent. was produced in the Empire, and was made up as follows: 65 per cent. of the fine cotton (total production 2,644,000 bales), 12 per cent. of the medium cotton (19,210,000 bales) and 59 per cent. of the short cotton (6,810,000 bales). He mentions the liability to extreme fluctuations of supply and price of cotton as one of the factors leading to extension of cultivation outside the United States. Chapter II on the Liverpool Cotton Market traces the evolution and elaboration of the futures market; the section on finance is an excellent piece of descriptive economics and might well be tacked on to the usual text-book exposition of foreign trade to illustrate the actual mechanism. The account of the Lancashire cotton industry in Chapter III gives an outline of the chief manufacturing processes through which cotton passes, and it is interesting to notice in a period of large scale and comprehensive industrial units, that specialisation in spinning, weaving, dyeing, and bleaching appears to be more economical than the carrying on of all the processes by one firm. In Chapter IV—the World's Consumption of Cotton and Cotton Goods—it is stated that the centre of the industry has shifted, whereas Europe before the war had 70 per cent. of the worlds spindleage (total 112,192,000 spindles) in 1927 it had 63 per cent. of a total of 164,616,000 spindles.

G. W.

BOOKS RECEIVED.

AGRICULTURE.

Animal Nutrition. T. B. Wood, pp. 226, *University Tutorial Press, Ltd.*, 3s. 6d.

Indian Agriculture. A. Howard and G. L. C. Howard, pp. 98, *Humphrey Milford*, Rs. 2/8.

CHEMISTRY.

Practical Physical Chemistry. Alexander Findlay, pp. 298, *Longmans Green & Co., Ltd.*, 7s.

The Phase Rule and Its Applications. Alexander Findlay, pp. 326, *Longmans Green & Co., Ltd.*, 10s. 6d.

ECONOMICS.

The Marketing of Farm Products. L. D. H. Weld, pp. 484, *Macmillan & Co., Ltd.*, 12s.

The Farmer and His Market. Land and Nation League, pp. 116, *E. Benn*, 1s.

International Year Book of Agricultural Legislation, 1926, pp. 778, International Institute of Agriculture, Rome, 12s. 6d.

Immigration Restriction. Roy L. Garis, pp. 376 *Macmillan & Co., Ltd.*, 17s.

A History of Village Communities in Western India. A. S. Altekar, pp. 144, *Humphrey Milford*, 4s. 6d.

The Co-operative Movement in India, P. Mukherji, pp. 468, *Thacker Spink & Co.*, Rs. 6.

GENERAL.

Papers on the Ethnology and Archaeology of the Malay Peninsula. Ivor H. N. Evans, pp. 164, *Cambridge University Press*, 15s.

The Editor will be pleased to send a gratuitous specimen copy of *Tropical Agriculture*, post free, to anyone interested in tropical development.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

Citric Acid Monopoly in Italy.

The Italian Government has decided to establish a monopoly in the manufacture of citric acid in Italy. The distribution of Italian calcium citrate has been controlled since before the war by a Government institution, the Camera Agrumaria, which now holds stocks amounting to some 10,000 tons, in addition to some 5,000-6,000 tons from last year's crop. A combine consisting of the three Italian manufacturers of citric acid is to have the first call on all the calcium citrate from which citric acid is made, and the amount available for export will depend on the requirements of the combine. It thus seems that the decision aims at the establishment of an Italian monopoly of citric acid. Abundant resources, however, await utilisation within the British Empire, and the Italian monopoly may stimulate the establishment of an Empire Industry.—*J. Soc. Chem. Indus.*, Vol. 47, No. 12, p. 316, 1928.

* * *

The Use of Tropical Waste Products.

Many tropical products which are at present wasted may become a valuable source of cellulose. A recent patent records a method for the conversion of soft and hard woods, cane bagasse, grass, banana stalks and leaves, coconut husks into cementitious material from which moulded articles can be made. The waste material is boiled under a pressure of 70-100 atmospheres with dilute solutions of salts such as sodium, potassium, magnesium and aluminium sulphates. In some cases, the sulphates, chlorides, or nitrates of copper, cobalt or nickel are added. Certain mixed salts such as kainit, may also be used. By using carefully modified treatments, the resulting products may be varied from stiff fibre for brushes to material for moulded articles. A further patent provides for making paper and pulp board from sugar-cane bagasse bound together by the longer fibres of the bagasse from sisal leaves.

* * *

Rubber Paint.

One of the first developments in the use of themoprene has been the production of a rubber paint. The production of a satisfactory paint including raw rubber is beset by considerable difficulties. A solution of rubber in organic solvents, unless very dilute, is too viscous for brushing or spraying, and tends to remain tacky unless heated, or allowed to dry for several days, or vulcanised on the material. A solution of themoprene in organic solvents is without these objections, and it is claimed to constitute an almost ideal paint. It has good adhesive power to metals; it is resistant to corrosive chemicals of all kinds; it has low permeability to moisture and salt solutions; the film is tough and can be bent without cracking; it does not flake when cut nor does rust spread quickly from exposed areas; ordinary paint pigments can be readily incorporated with it. Those properties have been tested on over twelve hundred metal panels exposed to various conditions. If its durability is sufficiently great, a paint possessing such properties should prove of great value in protecting agricultural machinery, exposed factory plant and galvanised roofs, and especially with metal exposed to various salts action.—(H. Gray, *Ind. and Eng. Chem.*, 20, 156, 1928.)

* * *

The Toxicity of Cotton-Seed Meal.

Further experiment on the removal of the toxic constituent of cotton-seed meal have been made. This constituent, known as gossypol, affects both the growth and reproduction of cattle feeding largely upon the meal. Attempts to destroy the toxicity by autoclaving the meal before feeding it to cattle, and to remove it by first extracting the meal with ether, were made. Three sets of experiments were performed, in which cattle were fed on a diet containing 35-45 per cent. of untreated meal, autoclaved meal, and ether-extracted meal, respectively, the first set acting as a control. Although the ether removed some gossypol, the meal was still toxic, the animals fed upon it showing poor growth and reproduction. The autoclaved meal still contained some gossypol, but it had practically no toxic effect, and the animals thrived on a diet containing meal treated in this way.—(W. D. Gallup, *Journ. Dairy Soc.* 10, 519, 1927. *See* This Journal, 4, 174, 1927.)

IN the *Sugar Supplement* to this Journal (Sept. 1927, Vol. IV, No. 9), methods of sampling sugar-canes were briefly discussed in an article on Chemical Research Problems in Cane-Sugar Production, pp. 41-46. Since this article was written, it has been brought to the notice of the writer that a hypodermic syringe method of sampling sugar-canes has already been tried in India by Mr. B. Viswanath ("Studies in the Chemistry of Sugar-Cane," *Agric. Journ. India*, 1919, Indian Science Congress Number, Vol. XIV, pp. 440-475).

The writer wishes to acknowledge his gratitude to Mr. T. S. Venkatraman, of the Imperial Sugar-Cane station, Coimbatore, India, for calling his attention to this fact, and to express his regrets to Mr. Viswanath that he was unaware of the publication of his paper at the time of writing.

From Mr. Viswanath's account of his work, it would appear that the method is quite satisfactory, and that, when the syringe is used in conjunction with a refractometer for rapidly measuring the sugar content of abstracted juices, the method might furnish a reliable means of testing canes in the field.

F. HARDY.

Photo by *L. Tucker.*

FIG. V—HERD OF GRADE FRIESIAN COWS.

Cross between pure bred Friesian sire and grade Zebu dam.

Photo by *L. Tucker.*

FIG. VI—HERD OF BLACK GRADE FRIESIAN COWS.

Progeny of half-bred Friesian parents.

(*The Herds are described in the article appearing on page* 131.)

Photo by *L. Tucker.*

FIG. VII—PRUDE.

Best cow of the Grade Friesian Herd (1927 *milk yield*=12,000 *lb.*).

Photo by *L. Tucker.*

FIG. VIII—MARY II.

Best cow of the Black Grade Friesian Herd (5,000 *lb. milk in* 275 *days*).
(*The two cows are referred to in the article appearing on page* 131.)

SUGAR NOTES.

Compiled by the College Department of Sugar Technology.

Preparation of Sugar Cane for Milling.

D. M. Semple (before Sugar Technologists, Association of India, Nov. 7-8, 1927) lists the advantages of preparing sugar cane for crushing by the mill rollers, and observes that there is no one best method, good results being obtained in various ways. It is erroneous to suppose that addition of pre-crushing units to an existing mill will necessarily increase the load on the power house. Where careful account has been kept of the power absorbed by the milling station before and after installation of a cane preparing device it is generally found that the total power consumed has not been increased. This is true, however, chiefly when the share of power going to the cane preparing device is ample thoroughly to break down the cane.

The chief benefits arising from the proper preparation of the cane are:

(1) A higher extraction of juice by the first mill, which makes the work of the succeeding mills lighter and results in a higher extraction for the mill as a whole. However, to get full advantage of finely divided megasse, the mills must be suitably grooved and well provided with drainage grooves.

(2) Maceration is more efficient the better the cane has been prepared. Thoroughly disintegrated cane is in fact, essential to the successful maceration as understood in Hawaii, that is, fresh maceration water is applied only before the last mill, being caught and returned to the preceding mills on the counter current principle. The Cuban mill engineers apparently do not like this system, as when all the water goes before the last mill there is much slipping of the rollers, due to the wetter megasse; they, therefore, distribute the maceration water between the last two or three mills and are content with the lower extration for the sake of a greater grinding rate. The remedy is more thorough disintegration of the cane at the front end; the more finely divided megasse will absorb a larger quantity of water without a tendency to slip, provided there are sufficient drainage grooves. In this way some Cuban mills have found that high capacity and high extraction can go hand in hand.

(3) When the cane is properly prepared the function of the mill becomes that of merely squeezing out the juice, and stoppages become greatly reduced.

A prerequisite to any method of satisfactorily milling sugar cane is a properly operating cane carrier which is capable of speeds carrying from nothing up to 60 feet per minute. The carrier should have an independent engine of ample power.

Cane preparing devices fall into two main classes: those with which no attempt is made to extract the juice (knives, shredders), and those in which some juice extraction results (crushers and crusher-shredders). The most effective knives are those set close to the carrier slats, which revolve at 500 r.p.m. and consume about 1½ h.p. per ton of cane per hour; such knives admit of reducing the openings of an 84-inch mill from 1½ inch to ¾, with gain in capacity. Among shredders the author favours the Searby. The Morgan shredder (in which cane is cut up and reduced to a fine powder, which is blown to a mill through a 10-inch pipe) seems to have given successful results at Central Guanica, Porto Rico. Among crushers the author favours the 3-roller crusher, as used in Haiti and elsewhere. The general conclusion is that where investment costs must be kept low, good milling results are obtained by the use of revolving cane knives, a 3-roller crusher and a 9-roller mill. For grinding hard canes with high capacity and extraction he recommends revolving cane knives, 2-roller crusher with independent engine, a Searby shredder, and either a 9-roller mill and one engine or a 12-roller mill and two engines. —*Facts about Sugar*, 23 No. 7, p. 154.

* * *

Glucose Determinations.

It has been the opinion of some writers that neutral lead clarification was unnecessary as a preliminary to a reducing sugar determination in molasses. H. A. Cook and W. R. McAllep, (*Hawaiian Planters' Record*, Vol. XXXII (1928), pp. 142-156), found decidely lower results after treatment with lead acetate, due to removal of non-sugar reducing substances. The amounts of these reducing non-sugars are sufficient to affect the results, hence lead clarification is necessary.

It was further found that neither potassium oxalate nor disodium phosphate have any reducing power. The presence of lime salts, however, caused low results in solutions of known invert sugar content, but treatment of these solutions with potassium oxalate restored the reducing power to practically its original value. Disodium phosphate is not completely effective in preventing this influence of lime salts.

It was also found that the presence of excess of lead caused low results. Comparative experiments were made with potassium oxalate and disodium phosphate as de-leading agents. Examination of the filtrates from tests with these agents showed that when potassium oxalate had been used the filtrate contained no lime, but an appreciable amount of lead; on the other hand, the disodium phosphate removed all the lead but left some lime. As both lead and lime affect the results the most suitable de-leading agent is a mixture of these salts (in the proportion of 2 : 8 or 3 : 7 grams. in 100 c.c.).—(*Facts About Sugar*, XXIII, 13, p. 298).

COLLEGE NEWS.

Professor F. Hardy accompanied by Mrs. Hardy and child sailed for England by the s.s. *Bayano* on 1st May on four months' leave.

* * *

At a meeting of the Trinidad Science Club on Thursday, 26th April, Dr. S. C. Harland gave a lecture on "Miscegenation."

* * *

The thanks of the College are again due to Mr. J. W. Stephens for his very generous gift of a medal which is to be presented to the best third year Student of the Diploma Course.

* * *

Mr. W. Scott, Professor of Sugar Technology, has been nominated to represent the College on a Committee of the International Committee of Sugar Technologists to consider the question of "Uniformity in Reporting Factory Data."

* * *

There has recently been received a ship's bell for erection at the Dining Hall. This bell was formerly on H.M.S. *Lily* and has been obtained and presented to the College by Sir Algernon Aspinall to whom a grateful acknowledgment of the gift is extended.

* * *

Our thanks are due to Professor Wood, C.B.E., M.A., F.R.S., F.I.C., Director of the School of Agriculture, Cambridge, and also a Governor of the College, for his very welcome gift of bound volumes of the *Field*, the *Farmer and Stock Breeder Country Life*, and of the *Estate Magazine* for the year 1927.

* * *

Dr. Lawrence P. McGuire, M.Sc., Ph.D., has been appointed Plant Physiologist in connexion with Banana Research at the College. Before proceeding to Trinidad he will make special studies at the Imperial College of Science and Technology in London, and the Low Temperature Research Station at Cambridge University.

* * *

Our thanks are due to the International Harvester Co., Chicago, for presenting the College with a 4-foot bumper disc harrow fitted with eight 16-inch Discs and a fore carriage. The implement will be specially useful for ploughing in green crops. The presentation was made through the Company's local Agents, Messrs. Geddes Grant.

* * *

An interesting collection of books has been given to the Hostel Library by Mr. William A. Cadbury. The set of books includes several by W. H. Hudson as well as many other interesting volumes including *The Arcturus Adventure* by William Beebe. The donor's generosity is much appreciated and we wish to thank him for his most useful gift.

Recent visitors to the College include Mr. R. A. Taylor, M.P. for Lincoln and Mrs. Taylor, Mr. James W. Pearl and Mr. R. G. Allan; Mr. Ian Parker, of Messrs. Sandbach, Parker & Co., who own Plantation Diamond and other sugar estates in British Guiana, Mr. C. H. Palmer, the manager of Marionville, Essequibo, British Guiana, and Mr. F. F. Ross, of Messrs. Davson & Co., of British Guiana.

* * *

On the 29th April the College Hockey Team again travelled South to Pointe-a-Pierre and won their match by eight goals to six. Teams from the College visit Pointe-a-Pierre several times each season to meet the South or the Leaseholds at Rugger, Soccer, and Hockey. On each occasion the teams are given a hard clean game, and unstinted hospitality at the Pointe-a-Pierre Club House before and after the games. We would, therefore, on behalf of the College teams and other visiting members from the College, like to express our appreciation of the generous hospitality extended to us by all in the South. Our sincere thanks are due to the ladies who provide and supervise the teas, and in this connection special mention is made of Mrs. H. C. W. Johnston and Mrs. F. L. Melvill who are almost always present often at the expense of their own Tennis and other engagements.

* * *

Dr. C. W. Wardlaw who has been appointed plant pathologist for banana research under the Empire Marketing Board arrived from England by the s.s. *Ingoma* on 21st April. Dr. Wardlaw was educated at Paisley Grammar School and Glasgow University where he obtained a B.Sc., degree in pure Science in 1921 and first class honours in Botany in 1922. In 1925 while holding a lectureship in Botany and Mycology at this University he was awarded a Ph.D., for research work in Plant Morphology. He was elected a member of the Royal Society of Edingburgh in 1927 and became a Doctor of Science in 1928 in recognition for his work on a Lanarkshire Strawberry Disease and on Plant Morphology. He has made studies in Botany, Mycology and Plant Pathology at Geneva University, the Imperial College of Science, and at the Jodrell Laboratory, Kew Gardens. Dr. Wardlaw's headquarters will be at the Imperial College where his activities will be mainly concerned with the Panama disease of bananas.

SOUTH AFRICAN ORANGES.

SERIOUS floods in the South Eastern Province of Cape Colony, where some of the best Citrus fruit is grown have done considerable damage to the coming orange crop. Many well known marks are expected to yield only half and in some instances one third of last year's pack. In the Western Province and in the Transvaal however, good crops of Citrus are expected.

BRITISH GUIANA EXPEDITION.

A PARTY of twenty-two post-graduate students, accompanied by the Principal, the Professors of Botany and Agriculture and the Lecturer in Agriculture paid a visit to British Guiana during the Easter vacation, leaving Port-of-Spain on the 25th of March and returning on the 1st of April. The time was short but through the courtesy of the Government and the untiring energies of Professor Dash, formerly Professor of Agriculture at the College and now Director of Agriculture in British Guiana, and his staff, a very full programme was put through and a most enjoyable and instructive time spent in a country which was new to all members of the party.

It was entirely due to the courtesy of the owners that it was possible to make excursions to plantations situated on the East and Essequibo coasts and on the East bank of the Demerara River, while visits were also paid to the Botanic Gardens, Nurseries and Experimental Fields, to the Laboratories and Offices of the Department of Agriculture and to the Museum and the Reading Rooms of the Royal Agricultural and Commercial Society and to the Forestry Department. A special reception held at the Director's House, two dances and a rugby match which was lost by the College after a severe contest, completed the programme.

The two principal crops of British Guiana are rice and sugar, the cultivation of which is mainly confined to the coastal belt, a wonderful stretch of alluvial land said to be derived from the sea-borne mud from the Amazon. This is largely below sea level but much capital has already been invested in its reclamation. The land possesses its own difficulties but is capable of producing, when well farmed, very heavy crops of both rice and cane. There is a very large area on the Essequibo coast where rice cultivation could be extended as all conditions here, with the exception of population, are favourable to a heavy production of good quality rice; yields run high and there is a market close at hand in the West Indian Islands. At Plantation Taymouth Manor where rice is produced on a commercial scale, a rice factory with steaming and milling tanks and a hot air drier supplementing sun drying has been built. The grain produced is of good standard and almost free from red-bearded rice.

Of the many things of interest seen during the tour were a small crushing plant and drying ovens for copra at Plantation Enmore, a home made grubber and selected seedling cane plots at the Diamond Estate, while at the Agricultural Sub-station, Plantation Cecilia, the party inspected plots of tobacco, onions, green and fibre crops which are all grown on a small scale for the benefit of peasants. Farmers are encouraged to try new crops and to improve their methods of cultivation by attending weekly demonstrations. The beautiful Botanical Gardens and Mr. Peterkin's experimental rice plots deserve special mention.

Wherever the party went they were welcomed and the information for which they asked freely supplied. Every assistance was given both officially and privately to make the tour a success and the thanks of the College are gratefully returned for the opportunity afforded by the kind invitation of the Government of British Guiana.

TRINIDAD CACAO.

A LARGELY attended meeting was held at the College on 18th April, when a scheme for the development of biological research on cacao was discussed between representatives of cacao interests in the Colony and members of the Staff. Briefly, the object of the scheme, which was based on a memorandum by Professor E. E. Cheesman, is to collect the necessary information for the improvement of both the yield and quality of cacao crops of the Empire. The total cost has been temporarily estimated at £12,700, for the first year and, while capital expenditure which includes the purchase of an estate is provisionally put at £10,000 the recurring annual expenditure will amount to £2,700. The scheme was unanimously approved by those present at the meeting and Mr. George Huggins, O.B.E., stated that the Government should be asked, if necessary, to place a cess on cacao to secure funds to carry out either the whole or part of the research work involved.

It is hoped, however, to finance the scheme partly with the aid of the Cocoa and Chocolate Manufacturers, and partly from funds provided by the Cocoa producers of the Empire.

ACKNOWLEDGMENT.

THE College has been presented with a fumigating tent and a dosage duster for experiments and demonstrations in connection with the use of Cyanogas as an insecticide.

The representative of the American Cyanamid Sales Company recently visited Trinidad in connection with the trials being made with Cyanogas for the control of the froghopper of the sugar-cane. The presentation of this outfit to the College has been made as one of the results of that visit.

The outfit consists of a 40-foot tent suitable for the fumigation of fruit trees and a Cyanogas fan blower designed to deliver Cyanogas accurately and easily in doses from one ounce or as required for tree fumigation.

The thanks of the College are due to the management of the American Cyanamid Sales Company, to whom grateful acknowledgments are made.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—April prices per cwt., *c.i.f.*, ranged as follows: Preferential, 17*s.* 1½*d.* (2nd April); 17*s.* (5th April); 16*s.* 9*d.* (16th April); 16*s.* 7½*d.* (29th April). Foreign, 96°, 13*s.* 6*d.* (2nd April); 13*s.* 3*d.* (13th April); 13*s.* (16th April); 12*s.* 10½*d.* (29th April). Markets have been quiet and buyers have shown less inclination to operate while holders have been content to await developments. In the middle of April markets were adversely affected by the Cuban President's statement that further reduction of the Cuban production may not be necessary in future and his later pronouncement—that if present measures are insufficient to maintain an even balance of supply and demand other means will be adopted—failed to find response in the market. As a result of the restricted Cuban exports, San Domingo has recently played a more important role as a supplier of refining sugars to the European market. Over 300,000 tons are expected to be available from this source and it is estimated that nearly 70 per cent. has been disposed of, practically all of which has been placed in European markets.

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COTTON.—The early April market showed a steady tone. Trade "calling" was moderate but persistent. Large consumption is making the market nervous about the next crop and climatic factors have not been very favourable. It is estimated that there will be a 7½ per cent. increase in acreage. On 4th April, Mid-American stood at 10.90*d.*; moderate business was being done in Egyptian, African and East Indian, and a small business was done in Sea Island.

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COCOA.—2nd May. Within the past few days the cocoa market has taken on a much stronger tone due to greater demand from American manufacturers. Recently these manufacturers have been pursuing a very cautious buying policy, and it would appear that they are now beginning to fear a shortage of supplies from producing centres. In this connection the principal supplier, *i.e.*: the Gold Coast has been continuing to report a short crop. Prices in the United Kingdom are from 4*s.* to 5*s.* per cwt., higher than a month ago, and in the case of New York about 7 cents per lb.—(*By courtesy of Cocoa Planters' Association, Trinidad.*)

COFFEE.—9,940 bags were offered at public auctions in the first week of April. The amount includes 4,198 bags of Costa Rica, 1,569 bags of East Indian and 3,992 bags of African, of which Kenyas contributed 3,309 bags. Kenya and Costa Rica were a good sale but Santos and lower grades were not easily placed. The nominal value of good ordinary Jamaica stood at 105*s.* to 107*s.*

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TEA.—A quiet trade is reported. Wholesale prices made at the beginning of April include Indian 16.18*d.*; Ceylon 18.44*d.*; Java 12.52*d.*

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RUBBER.—The spot price for plantation sheet ranged as follows during April, 1.1*d.* (3rd April); 9½*d.* (5th April); 7⅞*d.* (17th April); 8¼*d.* (29th April).

On 4th April, the Prime Minister made the following statement. "The Government have received the report of the Committee of Civil Research on the question of Rubber Restriction and they have decided that all restriction of the export from British Malaya and Ceylon will be removed on 1st November, 1928, the existing scheme being continued unaltered in the meantime." The effect of this announcement was an immediate drop in price amounting to about 2¾*d.* per lb. It is expected that estates will get to work at once with tapping, and that on 1st November when the restrictions on export are finally removed they will be in a position to flood the market. The fall in price may result in some agreement between the Dutch and British Growers who are investigating the possibilities of joint action.

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COPRA.—The market is a little steadier for all sorts. The quotation for West Indian (*c.i.f.*) was £27 15*s.* on 29th April.

COTTON STATISTICS.

STATISTICS relating to the consumption and stocks of cotton for the half-year ended 31st January have recently been issued by the International Federation of Master Cotton Spinners and Manufacturers' Association. The world consumption of all kinds of cotton was larger than expected and during the six months ended 31st January last was 12,987,000 bales against 13,412,000 bales in the previous half-year and 12,729,000 bales in the corresponding half-year of the previous season. The amount of American cotton used throughout the world during the six months under review was 8,226,000 bales which compared with 8,357,000 bales in the previous half-year and 7,423,000 bales in the six months ended 31st January, 1927. The total world consumption of American cotton amounted to 15,780,000 bales in 1926-27 and if the present consumption is maintained the United States will in future have to produce a crop each season of not less than 15,000,000 bales. The total world mill stocks of all kinds of cotton on 31st January last were 4,882,000 bales against 4,755,000 bales on the same date in 1927.